

# DC 504 COUNTER/TIMER

INSTRUCTION MANUAL

Tektronix, Inc. P.O. Box 500 Beaverton, Oregon 97077

Serial Number \_\_\_\_\_

070-1670-01 Product Group 75 First Printing JUN 1974 Revised DEC 1984

#### INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The lest five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

8000000	Tektronix, Inc., Beaverton, Oregon, USA
100000 -	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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#### **CHANGE INFORMATION**

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## SAFETY SUMMARY

The following text contains a two-part summary of genaral safety precautions that must be observed during all phases of operation, sarvica, and repair of this instrumant.

## **OPERATIONS SAFETY SUMMARY**

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions may be found throughout the manual where they apply, but may not appear in this summary.

#### **TERMS**

In This Manual:

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

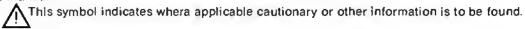
As Marked on Equipment:

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment Itself.

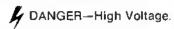
DANGER indicates a personal injury hazard Immadiately accessible as one reads the markings.

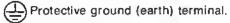
#### **SYMBOLS**

In This Manual:



As Marked on Equipment:







#### Grounding the Power Module

This instrument is grounded through the grounding conductor of the power module. To avoid electrical shock, plug the power module cord into a properly wired recaptacle before connecting to the instrument input or output terminals.

Do not use the power cord grounding conductor as the only grounding connection between two or mora devices. To avoid electrical shock, connect the grounding terminals together with saparata conductors.

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#### Use the Proper Power Cord

Use only the power cord and connector specified for the power module. Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see the power module manual.

Refer cord and connector changes to qualified service personnel.

#### Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your instrument, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

#### Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this instrument in an atmosphere of explosive gases unless it has been specifically certified for such operation.

#### Do Not Remove Covers or Panels

To avoid personal injury, do not remove the instrument covers or panels. Do not operate the instrument without the covers and panels properly installed.

#### Do Not Operate Without Covers

To avoid personel injury, do not operate this instrument without covers or panels installed. Do not apply power to the instrument via a plug-in extender.

## SERVICING SAFETY SUMMARY

#### FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

#### Do Not Service Alone

Do not perform internal service or adjustment of this instrument unless another person capable of rendering first aid and resuscitation is present.

#### Use Care When Servicing With Power On

Dangerous voltages exist at several points in this instrument. To avoid personal injury, do not louch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

#### Power Source

The power module is intended to operate from a power source that will not apply more than 250 volts between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential.

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Fig. 1-1, The DC 504.

# **OPERATING INSTRUCTIONS**

## INSTRUMENT DESCRIPTION

The DC 504 Counter/Timer measures frequency from 0.1 Hz (0 Hz with 0.1 Hz resolution) to at least 80 MHz. It measures period from 1  $\mu$ s to 999.99 s, end totelizes events from 0 to 99,999 at a maximum rata of at leest 80 MHz. A resolution of 0.1 Hz can be obteined by ellowing the more significent figures of the counter to overflow.

Five 7-segment light-emitting diodes (LED) provide a highly visible numerical display. The decimal point is automatically positioned and leading zeros (to the left of the most significent digit or decimal point) are blanked. Digit overflow is indicated by a front-panel LED.

Signels to be counted or timed can be applied to either a front-penel bnc connector or to the reer interfece connector. The DC 504 is designed to operate in any of the TM 500-Series Power Modules. It is completely competible with other members of the TM 500 femily in terms of signal interconnections.

The DC 504 is designed to operate in ambient temperatures between 0°C and +50°C. It can be stored in temperatures ranging from -40°C to +75°C. After storege in temperatures outside the specified operating temperatures, eliow the DC 504 to return to a room ambient temperature within the operating range before applying power.

## PREPARATION FOR USE

#### INSTALLATION AND REMOVAL



Turn the power module off before inserting the plugin; otherwise, damage mey occur to the plug-in circuitry.

Check to see that the plestic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the DC 504 circuit board edge connector. Align the DC 504 chassis with the upper and lower guides (see Fig. 1-2) of the selected compertment. Push the module in and press firmly to seat the circuit board in the interconnecting jack. To remove the DC 504, pull on the release letch (located in the lower left corner) until the interconnecting jeck disengages end the DC 504 will slide out.

Apply power to the DC 504 by pulling out the power switch knob of the power module.

#### CONTROLS AND CONNECTORS

Refer to Figs. 1-3 and 1-4. Even though the DC 504 is fully cellbrated end reedy to use, the functions and ections of the controls end connectors should be reviewed before ettempting to use it. Note that some thought must be given to the settings of the Internel switches shown in Fig. 1-3; for example, if you want to measure rpm, the RPM/NORM switch must be set for RPM. Also, if meesuring events that occur et a slow rete, the Input Coupling switch should be set for dc.

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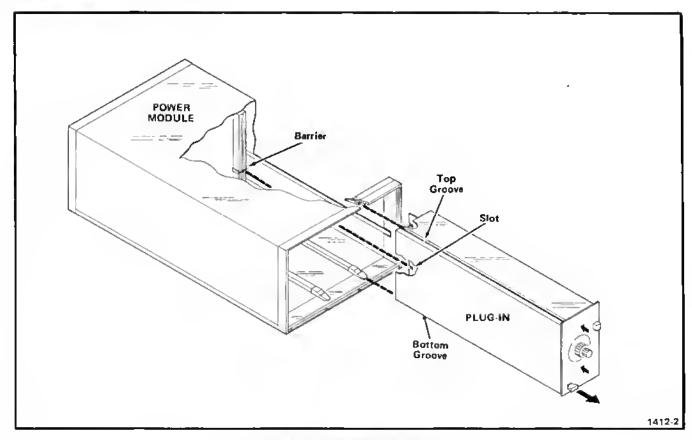


Fig. 1-2, Plug-in Installation and removat.

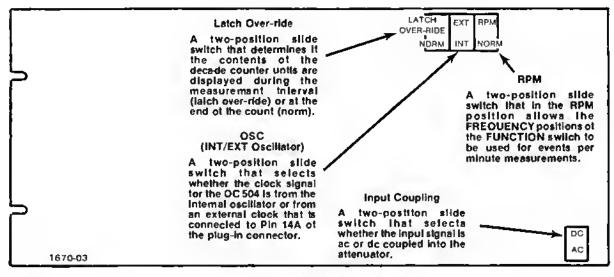


Fig. 1-3. Internal switch locations.

1-2

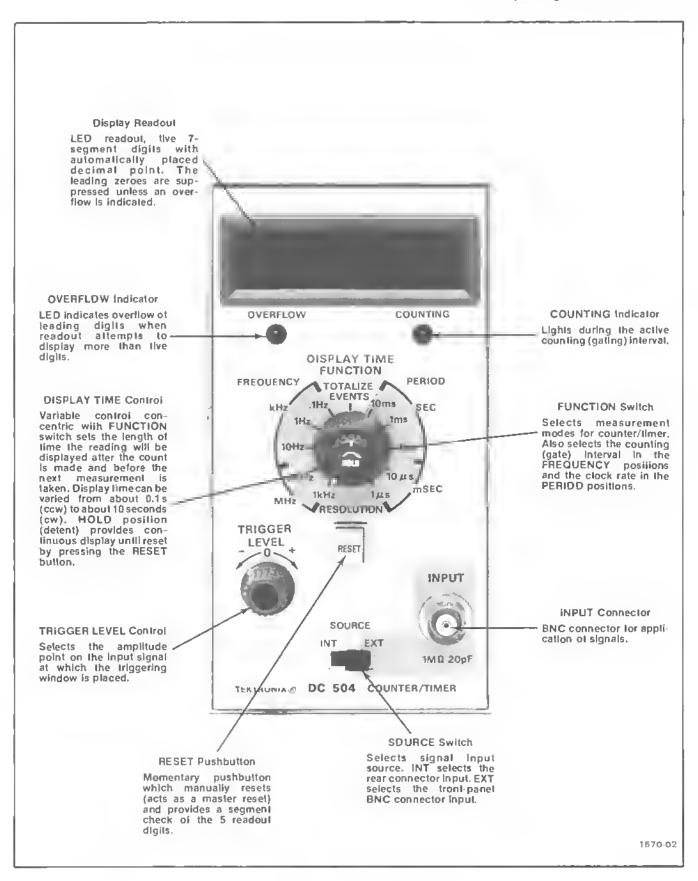


Fig. 1-4. Function of Controls and Connectors.

## INPUT CONSIDERATIONS

#### INPUT SOURCES

The front-penel SOURCE switch selects either the front-penel bnc connector (EXT), or the reer interfece connector (iNT) via pln 16A.

The externel input presents e high impedence of epproximetely 1 M $\Omega$ , perelleled by ebout 20 pF. The internel input circuit presents e nominel 50  $\Omega$  impedence to match typical coexial cable signal connections.

#### TRIGGERING

The TRIGGER LEVEL end input Coupling (internel switch) controls effect the counter's ebliity to make a measurement, in general, the trigger controls are similar to oscilloscope controls, axcept that the end result is not a stable waveform graphic display, but a stable digital frequency display.

Input Coupling Switch. An internelly mounted input Coupling switch (see Fig. 1-4) selects ac (cepecitive) or do (direct) coupling for the input signel. This coupling takes place efter the signel errives from the selected source end before it is pessed on to the fixed ettenuator. Ac coupling is convenient for most frequency measurements to evoid readjusting the TRIGGER LEVEL control for changing do levals, it does, however, reduce sensitivity to signels below 10 Hz. Thus, for period measurements longer then 0.1 s do coupling should be used.

TRIGGER LEVEL. The TRIGGER LEVEL control must be properly edjusted for a stable reading, it will not be difficult to edjust unless the signal empiltude or frequency is close to (or perhaps beyond) the specified limits. Lerge emplitude signals (≥5 V) at high frequencies (≥50 MHz) will cause the trigger point to shift negative from its normal 0 location.

A signei that looks stable on an oscilloscope may still show jitter when measured with a digital counter, if the count veries from reading to reading, it is probably due to jitter in the signel source. If the count changes unreasonably, the DC 504 is not being triggered properly, either because the controls are not set right or the signet is beyond the counter's capabilities (too small in amplitude or too high in frequency). A stable input signel will show only  $\pm 1$  count of jitter ( $\pm 1$  of least significant digit) when the DC 504 is properly triggered.

#### NOTE

The specified fitter for the DC 504 is  $\pm 0.5\%$  of one input cycle  $\pm 1$  count.

#### **MEASUREMENT INTERVALS**

To edjust the trigger controls, choose the TOTALIZE EVENTS position of the FUNCTION switch (or for eny FUNCTION switch position, menuelly over-ride the letch using the internal Letch Over-Ride switch). This gives repld feedbeck vie the displayes to whether the Counter is being triggered or not. If it is, numbers will eppear in the displey. Frequencies below 0.1 Hz will not be resolveble in the lowest frequency kHz scele. For such low frequencies, e period measurement is better suited.

#### MAXIMUM INPUT VOLTS, SENSITIVITY, AND FREQUENCY RANGE

The meximum sefe input voltage is 250 V (dc + peek ec) et 500 kHz or less. Above 500 kHz, the maximum sefe positive voltage decreeses linearly et 20 dB per decade. A ±5 volt input is tolerable at eny frequency.

The DC 504 will respond to signel amplitudes of et leest 20 mV, rms, (56.6 mV peak-to-peek) et frequencies of up to et leest 15 MHz, 35 mV, rms (99 mV peek-to-peek) up to 50 MHz, end 175 mV, rms (499 mV peek-to-peek) up to 80 MHz.

Depending on the coupling mode selected, the low frequency limit for the Input is either 0 Hz (dc coupled) or 10 Hz (ac coupled).

Beceuse of the very high input sensitivity of the DC 504, signel sources and coexiei cebles providing the input to the counter/timer must be termineted in their characteristic impedences if fest rise-time signeis (such as squere waves) are used as inputs. Otherwise, the Impedence mismatch wiil cause reflections or ringing along the input coexiei ceble. The undesired ringing peeks mey be of a lerge enough emplitude to trigger the DC 504, and the reading obtained will be an integer muitiple of the ectual input frequency. In addition, the reading mey very by Integer fectors as the TRIGGER LEVEL control is roteted. See Fig. 1-5 for exemples.

#### SETTING SLOPE AND LEVEL

The Trigger circuit responds to the positive-going trensition of the input signel for both frequency end period functions.

The TRIGGER LEVEL control ellows the operator to move the hysteresis window of the trigger circuit to an optimum level on the input signal to ensure stable triggering. See Fig. 1-6. The TRIGGER LEVEL control edjusts over a nominal ±1.5 V range of the input signal. If a wider range is desirable, use ac input coupling or attenuate the input signals (use a 10X probe or attenuator).

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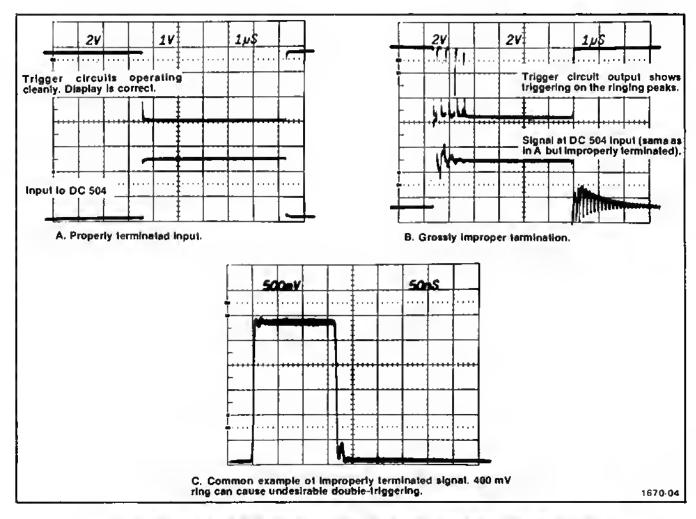


Fig. 1-5. Illustration showing effects of proper Input signal termination and Improper Input signal termination.

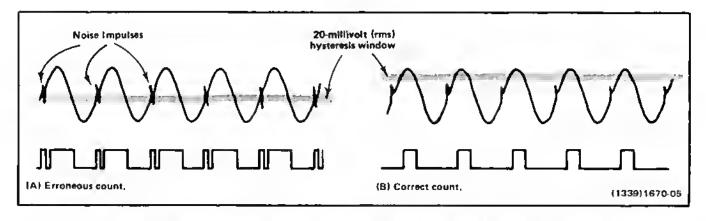


Fig. 1-6. Triggering circuit responses to Improper (A) and proper (B) TRIGGER LEVEL settings.

## **APPLICATIONS**

#### FREQUENCY MEASUREMENTS

To meesure end displey the frequency of e signal up to 80 MHz, set the FUNCTION switch to the eppropriete FREOUENCY position. Set the DISPLAY TIME control fully ccw, connect the signel to the INPUT connector, end set the SOURCE switch to EXT (front-panel bnc connector). You will note that higher resolution measurements take more counting time, e.g., a 1 kHz resolution measurement on the MHz scale requires 1 ms<sup>1</sup> while e 0.1 Hz resolution measurement on the kHz scale takes 10 s.

Final selection of FREOUENCY position of the FUNC-TION switch depends on the frequency being measured, desired resolution, and willingness of the operator to wait for a measurement. Using the FREOUENCY MHz position, higher trequencies may be measured, but at the expense of the greater resolution capabilities of the longer FRE-OUENCY kHz position.

Overflow. Through intentional use of "overflow" displays, it is possible to improve the resolution of the counter. Choose the FUNCTION switch position that displays the most significant number of the measurement as far to the lett as possible. Note the numbers displayed to the right of the decimal. Move the decimal point to the left by choosing a higher resolution FUNCTION position, if possible. The OVERFLOW LED will light when the most significant number overflows the last storege register. Note that the increased resolution does not chenge the accuracy of the measurement. Jitter in the Input signal will become more apparent as the resolution increeses.

Measurement Rete. Once e stable meesurement is obtained, the rete at which measurements ere mede cen be controlled by the DISPLAY TIME control. Turning the control cw holds off the counting and stores the display for a longer time before e new measurement is mede and displayed. Displey time end counting time together complete e measurement-display cycle.

The DISPLAY TIME control is uncelibrated end veriable from about 0.1 s et the ccw end to ebout 10 s at the cw end. At the cw end, there is a detent position celled HOLD. In HOLD, the last count taken will be stored end displayed for an indefinite time. A new count end display may be initiated by pushing the RESET button, by turning the DISPLAY TIME control ccw, or chenging the FUNCTION switch to any other position.

# REVOLUTIONS PER MINUTE (RPM) MEASUREMENTS

The internal RPM switch, when set to its RPM position, allows the DC 504 to be used as an rpm counter in the FREOUENCY positions of the FUNCTION switch. By moving the RPM switch to RPM, the gate times of the DC 504 are lengthened by a factor of six, so that the longest gate time becomes 1 minute, giving a "counts per minute" or rpm function. The decimal point is erased from the display in the rpm measurments to indicate that rpm rather than FREOUENCY is the selected function and to facilitate the use of transducers with other than 1 pulse per revolution. Teble 1-1 should be used to interpret the DC 504 front-panel markings and the rpm display readings.

Table 1-1

FUNCTIO	ON Switch	RPM	RPM	Read displey*
FREOUENCY	RESOLUTION	Gate Time	Resolution	number es
MHz	1 kHz	6 ms	10,000	rpm X10,000
MHz	.1 kHz	60 ms	1,000	rpm X1,000
kHz	10 Hz	.6 s	100	rpm X100
kHz	1 Hz	6 s or .1 m	10	rpm X10
kHz	.1 Hz	60 s or 1 m	1	rpm X1

'Assumes that transducer produces 1 pulse per revolution. If transducer produces 10 pulses per revolution, readings will be increased by a factor of 10.

The DISPLAY TIME control setting (about 0.1 s minimum) will effectively swamp out this short gate time.

#### **TOTALIZING**

In the Totalize Events mode, signel events epplied to the INPUT ere counted and the eccumulated total is displeyed until the reset button is pushed or the FUNCTION switch is changed to enother position. This mode is a manual enelog of the frequency mode. Its main application is to accumulate a count of relatively slow and irregular events.

Starting the Count, Apply the signel to the INPUT connector end set the trigger controls line same as for frequency measurement. Adjust the TRIGGER LEVEL control until the displayed total begins to increment. The accumulated count is displayed in whole numbers. In the Totalize Events mode, only the TRIGGER LEVEL control and the RESET button affect the display.

Stopping the Count. If pin 28B et the rear interfece connector is pulled to ground, the Totalize mode operation will be stopped (no more incoming events will be edded to the total). This is the most reliable method of stopping the count. A discrete transistor or open-collector logic should be used to pull pin 28B on the interfece connector low, i.e., pin 28B must not be forced high. Roteting the TRIGGER LEVEL control until the DC 504 no longer reacts to the input signal will also stop the totalize count. An extra count may be added to the total by rotating the TRIGGER LEVEL control cow through the 0 level.

#### NOTE

Connections to the rear interface connector ere to be made by qualified service technicians only.

Restarting and Resetting. When pin 28B at the rear interfece connector is allowed to go high, or when the TRIGGER LEVEL control is again edjusted to trigger the DC 504 on the input signal, incoming events will edvence the displeyed total.<sup>2</sup> Resetting the count to zero cen be

done at eny time by pressing the RESET button or by moving the FUNCTION switch to some other position, then back to TOTALIZE EVENTS position.

#### PERIOD MEASUREMENTS

Gating. Period meesurement is provided in counter/limers primerily to overcome e basic limitation of counters, i.e., the long time required to make a high-resolution, high-eccurecy measurement of low-frequency signals. For example, e 1 kHz signel requires 1,000 seconds of counting time to accumulate e million counts. However, in only one second, e 1 kHz signal can gate one million clock pulses from e 1 MHz clock into the counter.

Simply stated, the PERIOD mode reverses the functions of signel end clock es compared to the frequency mode. In frequency mode, signal events are counted for some number of clock pulses, then displayed. In PERIOD, clock pulses are counted for some number of signal events then displeyed.

Low Frequencies. Period measurements of signal below 10 Hz, and perticularly in the lowest decade from 0.1 Hz to 1.0 Hz, become rather sensitive to wave shepe and amplitude. Since it is destrable for the signal to pess through the trigger hysteresis abruptly, squere-wave inputs are preferred. Sine end triangle weves cen be measured accurately at the very low end if the input amplitude is kept somewhat ebove minimum specification so that the trigger input is driven hard.

#### NOTE

Be especially wary of high frequency ringing or noise on the input signal. They cen cause false triggering in the PERIOO mode.

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However, if the TRIGGER LEVEL control is rotated through the threshold point (0 level for zero volts dc) in a ccw direction, the displayed total will advance by one.

# FUNCTIONS AVAILABLE AT REAR INTERFACE CONNECTOR

#### **CONTROL LINES**

Solder pads have been connected to unassigned pins at the rear connector for routing signals to and from the DC 504 for specialized applications (see Rear Connector Pin Assignments). One or more compartments of a multiplug-in power module cen be wired with barriers instelled to provide specific functions between compartments. See the power module instruction manual for additional information.

A reset input line (pin 26A), which doubles as a reset output signal line, clears the counter to zero when a low is applied to the line.

An external clock signal may be used instead of the internal 1 MHz clock by connecting the external standard to the Ext Clock input line, pin 14A, and setting the internelly located Int/Ext Oscillator switch to Ext. A shielded cable connected between the E.O. solder points near pin 14A and U180 will be required.

The external oscillator input is somewhat duty-cycle sensitive. It is recommended that the positive portion of this input have a duty cycle of et least 15% but no more than 70%. Individual DC 504s may allow the user to exceed these limits by a smell margein. It is possible for large amplitude, fast-rise external oscillator signals to generate crosstalk with the internal 1 MHz et \$160. Thus it is recommended that the Ext Clock input be removed from pin 14A if it is not to be used for a period of time. Likewise, if you expect to use an external oscillator as the sole time base signal for the DC 504, then the internal oscillator can be disabled by removing Y160. Unsoldering at least one side of R180 from the circuit board will also suffice.

A Count Holdoff Input line forces the DC 504 into the "hold" mode as long as pin 28A is held high. The DC 504 display will hold the lastest measurement and will take another count only after the reset button has been pushed, the FUNCTION switch rotated, or the count holdoff signal goes low (or open).

A Totalize Start/Stop Input line can be used to inhibit the gate (stop the counting) in the TOTALIZE mode. In any other mode, the counting will stop and the display will go to zero after a time determined by the DISPLAY TIME control. Pin 28B must not be torced high or the gate will be forced open in all modes. Open-collector logic or a discrete transistor without a pull-up resistor is recommended to pull pin 28B1ow. Pin 28B is also used as a Gete Out signal line (see following text).

#### SIGNAL LINES

These lines provide for signal input, counter status and clock signal outputs, and bcd data outputs. An overflow output line (pin 23B) goes high to indicate that the counter is in an overflow condition.

The Reset output line is described above as a control line.

The Latch output line, (pin 19B) provides a positive "data good" pulse of about 10  $\mu$ s duretion at each updating of the display register.

The BCD Output data lines provide the count in an 8-4-2-1 serial-by-digit method. The output is active-high logic and is interpreted in conjuction with the Digit Select Out lines. The 8-4-2-1 lines are pins 20B, 20A, 21B and 19A, respectively.

The Digit Select Out lines consist of time-slot lines TS1—TS5. The output is active-high logic. The lines scan from the most significent digit to the least significant digit at about a 3.5 kHz rate. The TS1—TS5 lines are pins 25A, 24A, 23A, 22A and 21A respectively.

A Decimal Point Scanned Output line, (pln 27B) goes high only when the decimal point is to the left of the digit whose select line is high.

A Gate Out line, pln 28B, provides a signal that goes high during the time that the gate is open, i.e., while the input signal is gated into the decade counter units. This pin is also used as the Totalize Start/Stop input line.

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## REPACKAGING FOR SHIPMENT

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted. Include complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

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# SPECIFICATION AND PERFORMANCE CHECK

### **SPECIFICATION**

#### PERFORMANCE CONDITIONS

The electricel charecteristics ere velid only if the DC 504 hes been calibrated at an ambient temperature between +20°C end +30°C end is operating at enembient temperature between 0°C end +50°C unless otherwise noted.

Items listed in the Performence Requirements column of Table 2-1 are verified by completing the Performence Check in this manuel. Items listed in the Supplementel Information column ere not verified in this menual; they ere either explanetory notes or performence characteristics for which no limits ere specified.

Table 2-1
ELECTRICAL CHARACTERISTICS

Cheracteristics	Performance Requirements	Supplemental Information
	INPUT	
Frequency Range or Revolutions Per Minute (rpm)		
DC Coupled	0 Hz to et least 80 MHz	Coupling selected with an interna switch
AC Coupled	10 Hz to at least 80 MHz	Coupling selected with an interna switch
Sensitivity	20 mV rms (56.6 mV p-p) below 15 MHz 35 mV rms (99 mV p-p) at or below 50 MHz dereted to typically <175 mV rms (495 mV p-p) et 80 MHz (see Fig. 2-1)	Sine wave used for meesurement
input Impedance	1 MΩ paralleled by epproximetely 20 pF	
Maximum Sefe Voltege	250 V et 500 kHz or less; derete -20 dB/decade to 25 MHz. ±5 V from 25 MHz to 80 MHz	
Trigger Levei Range	Nominally -1.5 V to +1.5 V	
Triggering Error	≤0.5% of one cycle et minimum trigger sensitivity	
Signal Source	Internal (rear connector interfece) or externel (front penel bnc)	Selected by front panel SOURCE switch
Slope		Plus for ell functions
	DISPLAY	
Display Accuracy	±1 count ±time-base eccuracy ±trigger error	

		2-1 (cont)	
Characteristics	Performance Rec	quirements	Supplemental Information
Maximum Resolution			
FREQUENCY (or RPM)			
kHz Positions	0.1 Hz, 1 Hz, and 10 h (1 rpm, 10 rpm end 10		Seven digit resolution possible in overflowed kHz position
MHz Positions	0.1 kHz, and 1 kHz (1000 rpm end 10 k rp	om)*	Nine digit resolution possible in overflow kHz position
TOTALIZE EVENTS			Events being totalized must be positive going pulses at least 6.25 ns in width. The repeateble of the pulse must be at ieest 6.25 ns apart (l.e., 80 MHz squere-weve). The pulse amplitude must meet 80 MHz input sensitivity requirements. Less input amplitude will be required for wider pulses.
PERIOD mSEC Positions	1 $\mu$ s, and 10 $\mu$ s		A random error of up to 5 counts may occur in the 10 $\mu$ SEC period position when measuring periods of less than 2.00 ms. Such short periods should be measured in the 1 $\mu$ s period position to obtain higher resolution.
SEC Positions	10 ms, 1 ms, and 0.1 i	ms	
Display Time			Veriable from ebout 0.1 s to about 10 s. Detent position of DISPLAY TIME knob provides a HOLD mode.
	INTERNAL	TIME BASE	
	Standard	Option 1	
Crystal Frequency	(1 MHz)	(5 MHz)	
Stability 0°C to +50°C after 1/2 hour warm-up	Within 1 pert In 10 <sup>3</sup>	WithIn 5 perts In 10 <sup>7</sup>	
Long-Term Drift	1 part or less In 103 per month	1 part or less in 10 <sup>7</sup> per mont	h
Accuracy	Adjustable to within 1 part in 107	Adjustable to within 5 parts in 10°	

<sup>\*</sup>Assuming transducer output is one pulse per revolution.

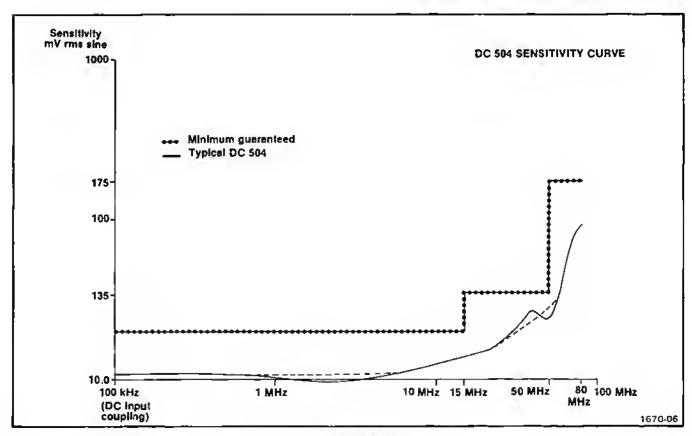


Fig. 2-1. DC 504 Sensitivity Curve.

Table 2-2
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Intermation
Temperature		
Operating	0°C to +50°C	
Storage	-40°C to +75°C	
Altitude		
Operating	To 15,000 feet	
Storage	To 50,000 feet	
Vibration Operating and Non-operating	With the instrument complete and operating, vibration frequency swept from 10 to 50 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 3 minutes at any major resonance, or if none, at 50 Hz. Total time, 54 minutes.	
Shock Operating and Non-operating	30 g's, 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes, for a total of 12 shocks.	

## PERFORMANCE CHECK

#### INTRODUCTION

This procedure checks tha electrical characteristics of tha DC 504 that appear in the Specification section of this manual. If the instrument fails to maet the requirements given in the performance check, the Adjustment procedure should be performed. This procedure can also be used by an incoming inspection facility to determine acceptability of performence.

The alactrical characteristics in this manual are valid only if the DC 504 is celibrated at an ambient temperature of +20°C to +30°C and operated at an ambient temperature of 0°C to +50°C.

Tolarances that are specified in this performance chack procedure apply to the instrument under test and do not include test equipment error. Limits and tolerances in this

procedure are instrument performance requirements only if stated as such in the Specification section of this instrument manual.

#### **TEST EQUIPMENT REQUIRED**

The following test equipment, or equivalent, is required to perform the performence check. Tast equipment characteristics listed are the minimum raquired to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test aquipment is assumed to be operating within tolerance.

Special test davicas are used where nacessary to facilitate the procedure. Most of these are available from Tektronix, Inc., and cen be ordered through your local Tektronix Field Office or representative.

Table 2-3
LIST OF TEST EQUIPMENT REDUIREMENTS

Description	Performance Requirements	Application	Example
Power Module	Provide power for DC 504 and other TM 500-Saries test equipment used in this procedure.	All staps.	TM 504 or equivalent.
Medium Fraquency Sina-wave Generetor	Output frequencies of 2 MHz, 15 MHz, 50 MHz and 80 MHz with variable p-p output amplitude from from 56 mV to 2.7 V.	Steps 3 and 8.	SG 503 Lavelad Sina Wava Genarator or aquivalant.
Low Frequancy Sina-wava Generetor	Output frequency of 10 Hz with a p-p output amplituda of 56 mV.	Step 8.	SG 502 Oscillator or equivalent.
Time-Merk Genarator	Markar outputs: 1 s, 0.5 s, 0.1 s, 50 ms, 10 ms, 5 ms, 2 ms, 0.5 ms, 0.1 ms and 50 $\mu$ s accurata within $\pm$ 0.1%.	Staps 5, 6, and 9.	TG 501 Tima Mark Generator or equivalent.
1 MHz Frequancy Standard	Output frequancy of 1 MHz accurate within 2 parts in 10 <sup>8</sup> (1 part in 10 <sup>9</sup> for Option 1).	Steps 7e and 7b.	Hawlett-Packard Model 105A/B <sup>b</sup> or equivalent.

For best accuracy, the frequency etandard used should be calibrated immediately before making this performance check.

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#### Table 2-3 (cont)

Description	Performance Requirements	Application	Example
50 Ω Feed-through Termination	Tolerance ±2%, bnc connectors.	Steps 3, 5, 6, 8 and 9.	Tektronix Part No 011-0049-01 or equivalent.
600 Ω Feed-through Termination	Tolerance ±2%, bnc connectors.	Step 8.	Tektronix Part No 011-0092-00 or equivalent.
50 Ω Coaxial Cable	Length 42 inches, bnc connectors.	Steps 3, 5, 6, 7, 8, and 9.	Tektronix Part No 012-0057-01.

#### PRELIMINARY PROCEDURE

#### NOTE

The performance of this instrument can be checked at temperatures between 0°C and +40°C. Make adjustments at a temperature between +20°C and +30°C (+68°F and +86°F).

- 1. Ensure that the correct nominal line selector block has been installed on the line selector pins on the power module interface board and the regulating range selected includes the applied line voltage. Refer to the installation section of the power module manual.
- 2. Remove the left side cover from the DC 504 and set the group of three slide switches to their down positions. Set the single slide switch (coupling) to its upper (DC) position. Replace the cover.
- Install the DC 504 and all TM 500-Series test equipment into the power module(s).
- 4. Connect the power module(s) and test equipment to a suitable line voltage source. Turn all equipment on and allow at least 30 minutes for the equipment to stabilize.
  - 5. Set the following DC 504 controls:

DISPLAY TIME

CCW

FUNCTION TOTALIZE EVENTS

TRIGGER LEVEL cw SOURCE EXT

#### PERFORMANCE CHECK PROCEDURE

#### 1. Check Display

- a. Push DC 504 RESET button and hold in.
- b. CHECK—For a display of 88888, and all segments have approximately the same intensity.
  - c. Release the RESET button.
  - d. CHECK-For a display of 0.

#### NOTE

The COUNTING light is continuously on when in the TOTALIZE EVENTS mode.

#### 2. Check Function Switch

a. Set the following controls:

#### DC 504

DISPLAY TIME ccw FUNCTION FRE

FREOUENCY MHz, 1 kHz RESOLUTION

TRIGGER LEVEL Fully cw
SOURCE EXT

All internal switches Down position

except the Input
Coupling switch
Internal Input

DC, up position

Coupling switch

#### Specification and Performance Check—DC 504

b. Check the switch functions and display in the following chart.

FUNCTION		RESOLUTION	DISPLAY
	6.81.3-	1 kHz	.000
	MHz	.1 kHz	.0000
FREQUENCY			
		10 Hz	.00
	kHz	1 Hz	.000
		.1 Hz	.0000
TOTALIZE EVENTS			0
		10 ms	.00
	SEC	1 ms	.000
PERIOD		.1 ms	.0000
	mSEC	10 <i>μ</i> s	.00
		1 μs	.000

- d. Connect the SG 503 Output to the DC 504 INPUT through a coaxial cable and a 50-0hm terminator. The terminator should be placed at the DC 504 end of the cable.
  - e. Turn the DC 504 TRIGGER LEVEL knob fully cw.
- f. CHECK—That the DC 504 is not triggered (display should be .000).
  - g. Turn the DC 504 TRIGGER LEVEL knob fully ccw.
- h. CHECK—That the DC 504 is not triggered (display should be .001).
  - i. Remove the SG 503 Output from the DC 504 INPUT.

#### 3. Check Triggering

a. Set the following controls.

#### SG 503

Frequency ≈2 MHz Amplitude Multiplier X1 Qutput Amplitude 2.7

#### DC 504

DtSPLAY TtME ccw **FUNCTION** FREQUENCY MHz. 1 kHz RESQLUTION TRIGGER LEVEL cw SOURCE EXT Down position All internal switches except the Input Coupling switch Internal Input DC, up position Coupling switch

- 4. Check Display Time Interval.
  - a. Set the following controls:

#### DC 504

DISPLAY TIME ccw
FUNCTION FREQUENCY MHz,
1 kHz RESOLUTION
All internal switches except Input
Coupling switch
Internal Input
Coupling switch
Coupling switch

- b. CHECK-Rapid blinking of COUNTING light.
- c. Turn the DISPLAY TIME knob slowly to cw position but not in detent.
- d. CHECK—That the COUNTING : light blinks progressively slower until, at the full cw position, COUNTING tight blinks approximately every 8 to 10 seconds.
  - e. Set the DISPLAY TIME knob to detent.
  - f. CHECK-COUNTING light stays off.
- b. Turn DC 504 TRtGGER LEVEL knob ccw until display changes from .000 to .001. Slight rotation about the "trip point" will cause the display to change between .000 and .001.
- c. CHECK—That the index on the TRIGGER LEVEL knob is pointed toward the top of the DC 504 and is approxtmately centered when at the "trip point."

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#### 5. Check Decade Counters.

a. Set the following controls.

#### DC 504

DISPLAY TIME

CCW

FUNCTION

TOTALIZE EVENTS

TIRGGER LEVEL

Midrange

SOURCE

EXT

All internal switches

Down position

except input

-

Coupling switch

Internal Input

DC, up position

Coupling switch

**TG 501** 

Variable Timing

In

Marker (sec)

.5 s

- b. Connect the TG 501 Marker Out to the DC 504 INPUT through a coaxial cable and a 50-ohm terminator.
- c. Adjust the DC 504 TRtGGER LEVEL so that the first digit least significant digit (LSD) starts counting.
  - d. Push the RESET button and release.
- e. CHECK—That the first digits count continuously and that all segments light properly.
- Repeat the above check for the remaining digits using the tollowing settings. Adjust the TRIGGER LEVEL as necessary for a count.

TG 501 MARKER (SEC)	DC 504 Digit
50 ms	Check 2nd
5 ms	Check 3rd
.5 ms	Check 4th
50 μs	Check 5th

- g. Push the RESET button.
- h. CHECK—Count starts over and the OVERFLOW light is off until the fitth digit counts past 9.
- i. Remove the TG 501 OUTPUT from the DC 504 INPUT.

- 6. Check Internal Switch Functions (Optional—Only those functions that are used should be checked).
  - a. Set the following controls.

#### DC 504

DISPLAY TIME

ccw

FUNCTION

FREOUENCY kHz,

,1 Hz RESOLUTION

TRIGGER LEVEL

Midrange

SOURCE All internal switches EXT

except Input

Down position

Coupling switch Internal Input

DC, up position

Coupling switch

WARNING

Dangerous potential exist at several points through out the DC 504. Remove the DC 504 from the power module or otherwise disconnect power module power before changing position of internal switches.

- b. Set the TG 501 marker diat to 2 ms.
- c. Connect the TG 501 Marker Out to the DC 504 tNPUT through a coaxiat cable and a 50-ohm terminator.
- d. Adjust the DC 504 TRIGGER LEVEL for a reading of approximately .5000. The reading won't appear for about 10 seconds.
- e. Set the Latch Over-ride switch (S245, the rearmost of the group of three internal slide switches) to its upper position. Turn off the DC 504 power, remove the left side cover to gain access to the switch, then replace the cover and re-apply power.
- t. CHECK—That The digits of the DC 504 are incrementing with each input pulse, rather than remaining at zero until the measurement is complete.<sup>3</sup>
- g. Set the Latch Over-ride switch (\$245) back to its down position.

If this function will not perform correctly (in Instruments before serial number B022370) R257 and R260 should be changed from 1 k $\Omega$  to 5.6 k $\Omega$ .

#### Specification and Performance Check—DC 504

- h. Set the TG 501 marker dial to .1 ms.
- i. Set the DC 504 FUNCTION to FREQUENCY kHz. 10 Hz RESOLUTION.
  - j. CHECK OC 504 to read approximately 10.00.
- k. Set the RPM switch (\$210, the frontmost of the group of three internal stide switches) to its upper position.
  - CHECK--OC 504 to read approximately 6000.
  - m. Set RPM switch S210 to its lower (NORM) position.
- n. Remove the TG 501 OUTPUT from the OC 504 INPUT.

#### 7a. Check Standard Clock Accuracy

a. Set the following controls.

#### DC 504

OtSPLAY TIME

ccw

**FUNCTION** 

FREQUENCY kHz:

.1 Hz RESOLUTION

TRIGGER LEVEL

Midrange

SOURCE

EXT

Att internal switches

Oown

- b. Connect the 1 MHz frequency standard to OC 504 INPUT.
- c. CHECK—OC 504 reads ≥9.9900 (999990.0 Hz) and ≤0.0100 (1000010.0 Hz) with OVERFLOW light on.

#### NOTE

Actual reading will depend on accuracy of input standard and the internal adjustment of the OC 504 clock. Note also that with ,1 Hz resolution, sixth decade and above digits overflow.

#### 7b. Check Option 1 Clock Accuracy

a. Set the following controls.

#### DC 504

**OISPLAY TIME** 

ccw

**FUNCTION** 

FREQUENCY kHz. .1 Hz RESOLUTION

TRIGGER LEVEL Midrange

SOURCE

EXT

All internal switches

Oown

 b. Connect the 1 MHz frequency standard to DC 504 INPUT.

c. CHECK—OC 504 reads ≥9.9995 and ≤0.0005 with OVERFLOW tight on.

#### NOTE

Actual reading will depend on accuracy of input standard and the internal adjustment of the OC 504 clock.

d. Remove the 1 MHz frequency standard from the OC 504 INPUT.

#### 8. Check Counter Sensitivity and Range

Set the following controls.

#### DC 504

OISPLAY TIME

TRIGGER LEVEL

cow

**FUNCTION** 

FREQUENCY kHz,

1 Hz RESOLUTION

SOURCE

Midrange EXT

All internal switches

Oown

SG 502

FREQUENCY (Hz)

1 X10

MULTIPLIER STEP ATTENUATOR

40

#### SG 503

Amplitude Multiplier

X.1

Frequency Range (MHz)

10 MHz-25 MHz

#### NOTE

Use en oscilloscope having adequate bandwidth to set specified signal amplitudes.

- b. Set the SG 502 Var Attenuator for a signal amplitude of 56 mV peak-to-peak, when termineted with 600-ohms.
- Connect the SG 502 sine-weve output to the DC 504 INPUT through a coaxial cable and a 600-ohm terminator.
- d. Set the DC 504 TRIGGER LEVEL es necessary to obtein a steble display.

CHECK-DC 504 reads .010, ±.001 (depends on frequency setting eccurecy of SG 502).

- e. Remove the SG 502 output from DC 504 INPUT.
- f. Connect the SG 503 Output to DC 504 INPUT through e coaxial cable and e 50-ohm terminator. The terminetor must be placed at DC 504 end of the ceble.
  - g. Set the DC 504 FUNCTION to 1 kHz.
- h. CHECK-Counter sensitivity from 15 MHz to 80 MHz using the tollowing table. Also check for e steble DC 504 display.

SG 503 FREOUENCY	SIGNAL AMPLITUDE (Peak-to-Peek)	DC 504 DISPLAY	
15 MHz	56 mV	15.000	
50 MHz	99 mV	50.000	
80 MHz	495 mV	80.000	

#### NOTE

When the three-digit accuracy of the SG 503 is expanded to five-digits on the OC 504, the displey rounding process in the SG 503 becomes apparent.

Remove the SG 503 Output from DC 504 INPUT.

#### 9. Check Period

Set the following controls.

#### DC 504

DISPLAY TIME

**FUNCTION** PERIOD SEC.

10 ms RESOLUTION

TRIGGER LEVEL

Midrenge

SOURCE Ail internal switches **EXT** Down

TG 501

Veriable Timing

IN

Merker (Sec) 1 s

- b. Connect the TG 501 Marker Output to DC 504 INPUT through e coexiel ceble and e 50-ohm terminator. The terminator must be placed at the DC 504 end of the cable.
- c. Adjust the DC 504 TRIGGER LEVEL as necessery for e display.
- d. CHECK-Period measurement function using the tollowing table.

#### NOTE

- Disregard leest significant digit (or ±1 count).
- 2. If a different generator is used for checking the period mode, its signal-to-noise must be high enough to ensure adequate triggering end it must be tree of eberretions and ringing with emplitudes larger than 50 mV peak-to-peak.

TG 501 MARKER (SEC)	DC 504 FUNCTION	DC 504 DISPLAY	
1 s	10 ms	1.00	
1 s	1 ms	1.000	
1 \$	.1 ms	1.0000	
,1 s	10 μs	100.00	
10 ms	1 μs	10.000	

e. Remove the TG 501 Marker Output from DC 504 INPUT.

This completes the Performance Check Procedure.

# **ADJUSTMENT**

#### SERVICE AVAILABLE

Tektronix, inc. provides complete instrument repair and adjustment at local Field Service Centers and at the Factory Service Center. Contact your local TEKTRONIX Fleid Office or representative for further information.

#### **TEST EQUIPMENT REQUIRED**

The test equipment listed in Table 3-1, or equivalent, is required 'for making adjustments to the DC 504. Test equipment characteristics listed are the minimum required to verify the accuracy of the adjustments made. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance,

#### **PROCEDURE**

#### NOTE

The performance of this instrument can be checked at any temperature within the 0°C to +50°C range. Make any adjustments at a temperature between +20°C and +30°C (+68°F and +86°F).

#### 1. Preparation

Place the DC 504 on a plug-in extender (Tektronix Part No. 067-0645-02). Plug the extender into the Power Module to be used. Turn on the Power Module and all test equipment. Allow 30 minutes warm-up time before proceeding.

Table 3-1
LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example	
Oscilloscope	1 MHz bandwidth or greater.	Time Base frequency check and adjustment.	Tektronix SC 501.	
Probe	10X attenuation to reduce circuit loading, 1 MHz bandwidth or greater, bnc connector.	Frequency check and adjustment.	Tektronix P6006.	
Power Module Provide voltages, currents and connections suitable for TM 500-Series test equipment.		All steps.	Tektronix TM 504.	
Plug-in Extender  Must make connections between DC 504 and Power Module so that the DC 504 can be operated outside the Power Module.		All steps.	Tektronix Part No. 067-0645-02.	
Frequency Standard	1 MHz output, accurate to within 2 parts in 10 <sup>8</sup> (1 part in 10 <sup>9</sup> for Option 1).	Frequency check and adjustment.	Hewlett-Packard Model 105A/B.	
Voltmeter	Measure 0 to 15 volts, accuracy within ±3%.	Measure power supply voltages.	Tektronix DM 501.	

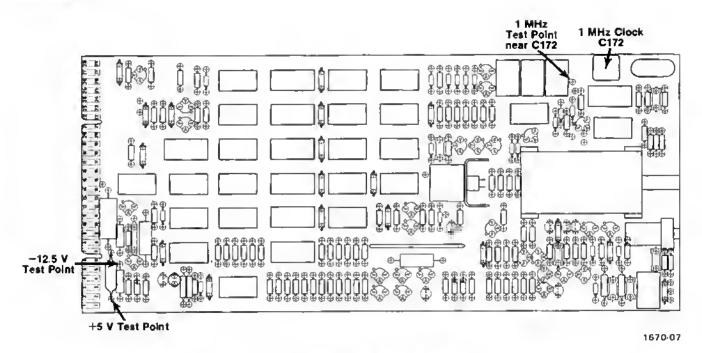


Fig. 3-1. Test point and adjustment locations.

#### 2. Check Power Supplies (see Fig. 3-1)

- a. Connect the voltmeter between the  $\pm 5$ -volt test point and ground.
  - b. Check that the voltage is +5 volts within ±5%.
- c. Check the voltmeter between the -12.5-volt test point and ground.
  - d. Check for a voltage of -12.5 volts ±0.5 volt.

#### 3. Check and Adjust Time Base Frequency

- a. Connect the DC 504 1 MHz (5 MHz for Option 1) time-base reference and the frequency standard to the oscilloscope as shown in Fig. 3-2. Adjust the oscilloscope to display several complete cycles.
- b. Observe the rate of horizontal drift of the displayed waveform. If the waveform moves to the right, it indicates the time-base frequency is less than 1 MHz; if it moves to the left, the frequency is greater than 1 MHz. The period in seconds for the waveform to move the width of one cycle is equal to the frequency difference in parts in 10°. For

example, if the waveform drifts to the right at a rate of one cycle every 10 seconds, the time-base frequency is 0.1 part in 10<sup>4</sup> low. Maximum allowable frequency difference is 1 part in 10<sup>7</sup>.

c. Adjust C172 for no observable drift (opening the plates of C172 increases the oscillator trequency, closing them decreases the frequency).

This concludes the Adjustment Procedure.

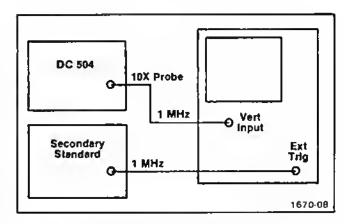


Fig. 3-2. Test setup for Time Base frequency check.

## **MAINTENANCE**

#### **GENERAL**

The Power Module Instruction manual contains the general maintenance procedures to be followed in maintaining the TM 500-Series plug-ins. This manual contains specific procedures for things not covered in the Power Module manuals.

#### **CLEANING THE CHASSIS**

The instrument should be cleaned by first loosening dust and other foreign matter with a small paint brush, then using a vacuum cleaner to remove the loosened material. Hardened-on dirt can be removed with water and a mild detergent solution. Isopropyl alcohol is also permitted as a cleaning agent. Do not use any other cleaning solutions or solvents.

#### **CLEANING SWITCH CONTACTS**

Use isopropyl alcohol for cleaning the switch contacts. Care should be taken to keep the alcohol away from the lubricated switch detents so that the lubricant is not removed or spread where It Is not wanted.

After cleaning, normally lubricated contacts can be relubricated with a no-noise lubricant (Tektronix Part No. 006-0442-00). Use this lubricant sparingly and keep it off the IC sockets.

CAUTION

Use only the lubricant recommended.

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# CIRCUIT DESCRIPTION

#### **BLOCK DIAGRAMS**

Two block diagrams are provided, A simplified block diagram that shows the relationship of the circultry on Diagram 1 with that of Diagram 2 is placed on the apron of Diagram 1. A detailed block diagram that shows the relationship of the various functions within the instrument is given on a separate foldout.

#### INPUT (DIAGRAM 1)

#### Input. Fixed Attenuation and Input Protection

Events to be counted or timed are applied to front-panel INPUT connector J100, or to plug-in connector (50  $\Omega$  nominal impedance) Pin 16A. Front-panel SQURCE switch S100 selects which input is fed to the amplifying and shaping circuits. Internal Input Coupling switch S102 (shown on the Controls, Connector and Interface Information foldout) allows the user to select either dc coupling or ac coupling (C102 is used to block out the dc voltage). The signal is then fed to a frequency compensated attenuator (R106-R108), which has a 1  $\mathrm{M}\Omega$  input resistance. The fixed attenuator provides current limiting overload protection for the DC 504.

# High Impedance Input and High Frequency Amplifier

A source follower consisting of O110A and Q110B presents a very high Impedance to the source and drives the succeeding circuitry from a low Impedance. Q110A and Q110B are a matched pair of junction field effect transistors, so matched that the quiescent output is at zero volts. The output of the source follower drives a high-frequency cascode amplifier consisting of Q114 and Q130. Front-panel TRIGGER LEVEL control R125 varies the bias on Q130, providing a variable dc offset to the input signal. This offset capability allows the DC 504 triggering point on the input signal to be selected. If the TRIGGER LEVEL control is rotated fully ccw, Q130 will be saturated, making its output independent of its input. This condition of Q130 may be useful as a manual gate control in the Totalized Events mode.

#### Signal Shaping and Schmitt Trigger

The output of the cascode amplifier is connected through emitter-follower O134 to the input of Schmitt trigger circuit Q140 and Q150. The Schmitt trigger produces jitter-free triggering for input signals having slow rise and fall times. The hysteresis width of the Schmitt trigger is designed for an overall sensitivity of 20 mV rms (56.6 mV peak-to-peak). This 20 mV window can be positioned over a nominal ±1.5 V range with the TRIGGER LEVEL control. The output of the Schmitt trigger is a low impedance, TTL compatible driving source for the following stages.

#### Time Base

The time base integrated circuit (U160) oscillates at 1 MHz as determined by crystal Y160 or option 1 crystal. Capacitor C172 permits the oscillator to be set to exactly 1 MHz. If an external clock is to be used, then the internally located Osc Int/Ext switch S160 (shown on the Controls, Connector and Interface Information foldout) is set to Ext and the external clock signal is connected to pln 14A of the plug-in connector. A shielded cable must be connected from the E.O. solder point near pin 14A to the E.O. solder point near U160.

The 1 MHz oscillator signal is decade divided by U160 to produce the gate signal for the counter/timer. The division factor for the gate signal is selected by placing the appropriate voltage levels on plns 11 through 14 of U160, see Table 5-1.

In rpm mode, the output of U210 is supplied via emitter follower Q210 to the FUNCTION switch in place of the normal time base output signal. Since the signal supplied to the FUNCTION switch from Q210 is six times longer than the normal time base signal, the counter measures a frequency that is six times higher. This results in cycles per minute (rpm) rather than cycles per second (If the decimal point is mentally shifted). The Operating Instructions section in this manual contains further rpm information.

Table 5-1

Division	Gate		U160 Pin Voltage Level				
Retio	Time	11	12	13	14	FUNCTION Switch Positions	
10°	1 μs	gnd	gnd	gnd	gnd	PERIOO mSEC — 1 μs RESOLUTION	
10¹	10 <i>μ</i> s	gnd	gnd	gnd	+5 V	PERIOO mSEC — 10 µs RESOLUTION	
10²	100 <i>μ</i> s	gnd	gnd	+5 V	gnd	PERIOO SEC — .1 ms RESOLUTION PERIOO SEC — 1 ms RESOLUTION	
103	1 ms	gnd	gnd	+5 V	+5 V	FREQUENCY MHz — 1 kHz RESOLUTION PERIOO SEC — 10 ms RESOLUTION	
10 <sup>4</sup>	10 ms	gnd	+5 V	gnd	gnd	FREQUENCY MHz — .1 kHz RESOLUTION	
105	100 ms	gnd	+5 V	gnd	+5 V	FREOUENCY kHz — 10 Hz RESOLUTION	
10°	1 s	gnd	+5 V	+5 V	gnd	FREQUENCY kHz — 1 Hz RESOLUTION	
10²	10 s	gnd	+5 V	+5 V	+5 V	FREQUENCY kHz — .1 Hz RESOLUTION	

#### Gate Generator

The Input to gate generator U220C, which produces the control signals for the counter, is determined by the position of FUNCTION switch S200. In the FREOUENCY positions of the FUNCTION switch, the input to the gate generator is the time base signal with a period determined by the RESOLUTION setting of the FUNCTION switch. In the PERIOO positions of the FUNCTION switch, the gate generator input is the DC 504 front-panel or plug-in connector input signal, after it has passed through the input amplifier and shaping circuits.

#### Operation of Frequency Mode

Assume that the cycle starts just after a reset signal (front-panel generated by RESET pushbution), or just after a CLEAR signal (internally generated before the next measurement cycle). A short time after the front-panel RESET pushbutton is released, the stretched reset pulse in the time base ends, and 1  $\mu$ s later the time base outputs a falling edge that is applied to inverter U215E via the FUNCTION switch. The signal from U215E is applied to pins 3 and 11 of U217, which is connected as a three-state counter. Prior to the falling edge from the time base, both pins 5 and 9 of U217 were set high by the CLEAR signal.

The first rising edge at pin 3 of U217 causes pin 5 to go low and pin 6 to go high. Since NANO gale U220O now has a high at both inputs, its output goes low. U215C Inverts the output of U220O and applies it to pin 9 of U220C, opening the gate. With the gate open, the amplified and shaped input signal to the OC 504 is inverted by U220B and applied through U220C to the decade counter units (OCU). The gate (U220C) can be forced to close by pulling pin 9 of U220C to ground through interface connector pin 28B, thus stopping the count. CR226 protects U215C when pin 28B is connected to ground.

The next rising edge from the time base (which occurs after a period T, selected by the FUNCTION switch RESOLUTION setting) keeps pin 5 of U217 low and also forces pin 9 togo low. This removes the high from pin 13 of U220O, causing its output to go high. The rising edge now occurring at pin 11 of U220O is applied to pin 3 of U255, a one-shot multivibrator, where it causes an output pulse approximately 10  $\mu$ s wide. This output pulse from U255 passes through a diode OR gate (CR257-CR245-CR246) and is buffered by O260 and O264. The pulse signal available at the output of O264 is the LATCH signal used for the OCU. The high output now available at pin 11 of U220O is also inverted by U215C and used to close the gate (U220C), forcing the output of U220C high regardless of the input signal to the counter.

When pin 9 of U217 went low due to the second rising edge from the time base, Q185 was turned off. Q185 turning olf allowed timing capacitor C190 to start charging toward ±5 V through R187 and R190, the front-panel DISPLAY TIME control. After a period of time, which is determined by the setting of the DISPLAY TIME control, C190 reaches a sufficient voltage level to fire unijuction transistor O195. C190 now discharges through Q195 and R195, causing Q198 to turn on. Q198 turning on generates a CLEAR signal that resets U217 and clears the DCU.

The U160 dividers for the gate control are reset to all nines, after the gate signal has occurred, by applying a positive pulse to pin 7 of U160. This reset allows the DC 504 counting cycle to restart immediately tollowing a reset or a clear pulse. It the U160 dividers were not reset to all nines, the delay balore the next count could begin would be equivalent to one gate-time interval. The nines reset pulse to pin 6 of U160 is stretched by C205 to make sure that all other counter circuits have been released from their clear pulses before the counter starts the next counting cycle.

The output of U160 occurs at pin 1. U180A synchronizes U160's output with the 1 MHz clock to reduce jitter. The time base output is then led to RPM switch S210. In the Norm (normal counter operation) switch position, the time base output runs directly to the FUNCTIQN switch and is connected to the proper circuit depending on the setting of the FUNCTION switch. In the PERIQD mode, synchronizer U180A is by-passed since time base jitter is not significant at low frequencies. Also, the RPM switch is by-passed since the RPM mode applies to frequency measurements only.

When S210 is set to the RPM position, the output of U180A is sent to the divide-by-six circuit consisting of U210. This unique divide-by-six circuit can be set to its maximum count (essentially tive) by pulsing pin 7 of U210 through O204. This allows U210 to be set to its maximum count at the same time U160 is set to all nines (its maximum count). The advantage of doing this maximum count resetting has been prevously explained.

When Q198 goes low (CLEAR), O200 is lorced high alter a delay determined by the rc network in its base circuit. Then when CLEAR is released, Q200 goes low after another delay. The Q200 signal is used to reset the time base to all nines, and the delay in going low ensures that the time base is the last part of the circuitry to be released from the clear.

# DECADE COUNTER UNITS (DIAGRAM 2)

The input to the decade counter units (DCU) is a gated series of pulses from the gate generator (pulses are at either the Iront panel input trequency for Irequency measurements, or are from the time base for period measurements).

The 10° through 10⁴ DCU is composed of five cascaded divide-by-ten counters. The first decade counter is a specially-selected decade divider that can operate at the maximum frequency capability of the DC 504. When the CLEAR signal to pin 13 of U294 Is high (U288, U282, U276, and U270 require a low signal on CLEAR) the counter is enabled. The input signal is applied to the clock input (pin 8), of U294. On every tenth clock input counted by the first decade counter, the output of U294 goes low, providing a carry signal that becomes the clock input for the second decade counter. Each subsequent decade divides by ten in a similar manner. Four bcd output lines are connected from each DCU to its associated storage-register/fatch. When the CLEAR signal is activated, all of the decade counters are reset to the zero-count state.

#### Storage Register and Gates

The Storage Register comprises latches U296-U290-U284-U278-U272; It stores the corresponding decade counter bod output. The bod output number is applied to the data inputs at plns 2, 6, 7, and 3 (2°, 21, 22 and 23 bits respectively). The LATCH signal is applied to the clock input at pins 4 and 13 of each latch at the end of GATE (negative transition on pin 9 of U220) or when the FUNCTION switch is placed in the TOTALIZE EVENTS position. While the LATCH signal is high, the logic levels from the decade dividers are read into the storageregister. The outputs of the latches are connected to gates (U298-U292-U286-U280-U274) that are controlled by the time-slot decoder. The gates place the bcd information sequentially on lines running to the seven segment decoder and on the bcd output pins of the plug-in connector.

#### **Overflow Register**

When the decade counters have counted 99,999, the counters are full. At the next count, the lalling edge at the 2¹ output of U270 (pin 11) is inverted by U220A and used as a clock signal for U260A. When the clock causes U260A to toggle, pin 6 will go low. The next latch pulse will cause pin 6 of U265, which is connected as a bistable multivibrator (RS latch), to go low, causing the Iront-panel QVERFLOW light emitting diode (LED) to light. Pin 11 of U265 goes high when pin 6 goes low to prevent the leading-zero suppression during the overflow condition. The OVERFLOW LED will stay on until the next LATCH signal occurs, at which time the magnitude of the count is again assessed.

#### Scan Clock

The scan clock determines the scanning rate of the time-slot decoder. The scan clock is a free-running (astable) multivibrator consisting of O300 and Q310 which runs at approximately a 3.5 kHz rate.

#### Time-Slot Decoder

The time-slot decoder consists of shift register U310 end gate U315B. The purpose of U315B is to guarentee thet only e single high is circulated in the shift registar (aftar the DC 504 has completed e single start-up scen). It does this by feeding lows into the shift register as it sequences, as long as e high exists in eny time slot except the last (leest significent digit) position. The shift register time slots, which control what displey digits will be energized and which letch will hava its count geted out, scan from the most significant digit (MSD), pin 15, to the least significant digit (LSD), pin 10. The time slots ere evallable on the plug-in connector plus es digit select outputs,

#### Power Inverters, Anode Voltage Enable and Decimal Point

The time slot outputs from the time-slot decoder ere buffered by high-current inverters (U325D, U325E, U325F, U325A, and U325B) end then used to enable the enode voltage supply transistors Q350, Q355, Q360, Q365, and Q370. The decimel point is positioned in the proper time slot by the cam switch. Inverter U325C provides the proper decimel point logic levels for the plug-in connector output and for leading zero blanking. The scanned decimal point belongs (decimal point appears) to the left of the digit thet is ective when the decimal scan goes high.

#### Seven-Segment Decoder and Leading Zero Suppression

The seven-segment decoder (U320) decodes the bcd information used to drive the savan-segment displey LED. U320 pulls the appropriate LED segment lines (LED cathodes) low, while et the same time the anode voltage enable transistors (Q350, Q355, Q360, Q365, end Q370) epply high levels to the appropriate LED digit lines (anodes).

U320 hes e zero blenking feature that, in combination with U2608 and U315B, provides leading zero suppression (blanking) for the DC 504 display. When one of the inputs to QR gete U315A goes high, its output goes low, setting pin 9 of U260B high. The high elipin 9 of U260B is epplied to a diode QR gete (CR320 and CR322) whose output forces pin 5 of U320 high. In this condition, ell input digits will be displayed (no zeros will be blanked). The conditions that can cause elow et the output of U315A ere:

- e. Time slot 5 (LSD) is high (LSD is always displeyed in Totalized EvenIs mode, even If zero).
- b. The decimal point is high (ell zeros to the right of the decimal point are displayed).
  - c. Qverflow has occurred.

The leading zero suppression circuit is reset to the blanking state by the leading edge of time-slot 1 through e differentletor circuit (C325 and R325) feeding the direct clear input (pin 13) of U2608. This will clease pin 5 of U320 to be held low by R322 end eny zero digit at the input to U320 will result in a blank displey. If a zero digit is sensed and blenked by U320, it responds by outputting e low level on pin 4. This low is recycled to U260B on the next scen clock pulse to ellow subsequent zeros to be blenked. If, however, e high (non-zero) is sensed, pin 4 of U320 goes high, setting U260B to unblenk on the next scan clock pulse. This disablas the zero blanking until U260B is reset by the next time siol 1 pulse.

When the front-panel RESET pushbutton is pressed, pin 3 of U320 is forced low while pin 5 is forced high. This results in all 35 (5 LED X 7 segments) LED displey segments being lit for verification.

# POWER SUPPLIES (DIAGRAM 3)

#### +5 Volt Supply

U400 derives a temperature-compenseted, highly regulated ±5 V from the ±33.5 V unragulated supply of the TM 500 Series Power Module. The NPN transistor, which is located in the power module tor proper heat dissipetion, is used for the series-pess Iransistor. R405 provides current limiting for the supply, while R400 will turn off U400 if the supply attempts to draw excessiva current through the IC.

#### -12.5 Volt Supply

The —12.5 V Supply Is derived from the TM 500 Series Power Module —33.5 V unreguleted supply. The supply consists of emplifier Q425 driving the PNP trensistor (located in the power module) es en emitter follower. The output of the emitter follower is divided by R432 end R435 and compared to the voltage across Zenar diode VR430. Any difference between the Zaner diode voltage and the voltage et the center of voltage divider R432-R435 Is coupled as feedback to the bese of Q425, which then drives the series-pass PNP transistor to correct the output voltage. VR430 and Q425 temperature compensate each other to the first order to provide a tempereture steble power supply.

Q428 protects the supply, in the event the output is shorted, by limiting the current demanded from the supply under excessive load. This is accomplished by heving Q428 monitor the supply current through R427.

# REPLACEABLE ELECTRICAL PARTS

#### PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Diffice or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, Instrument type or number, serial number, and modification number it applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field  $\dot{D}$  thice or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

#### SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

#### ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Calaloging Handbook H6-1 can be utilized where possible.

#### **ABBREVIATIONS**

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	DUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREDUENCY
COMP	CDMPOSITIDN	SEL	SELECTED
CONN	CONNECTOR	SEMICD-ND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	ww	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NDNWIR	NDN WIREWDUND	XTAL	CRYSTAL

### CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip  MT. HOLLY SPRINGS, PA 1706	
00136	MC COY ELECTRONICS COMPANY	WATTS AND CHESTNUT STR.		
1121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SDUTH	MILWAUKEE, WI 53204	
1295	TEXAS INSTRUMENTS, INC.			
	SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222	
4222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867	MYRTLE BEACH, SC 29577	
4713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036	
7263	FAIRCHILD SEMICONDUCTOR, A DIV. OF			
	FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042	
2969	UNITRODE CORPORATION	580 PLEASANT STREET	WATERTOWN, MA 02172	
3511	AMPHENDL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030	
4433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY		
		P O BOX 3049	WEST PALM BEACH, FL 33402	
4552	MICRO SEMICONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANTA ANA, CA 92704	
6546	GLOBE UNION INC. USCC/CENTRALAB			
02.40	ELECTRONICS DIV.	4561 COLORADO	LOS ANGELES, CA 90039	
2229	SOLITRON DEVICES, INC.,			
-220	SEMICONDUCTOR GROUP	8808 BALBOA AVENUE	SAN DIEGO OPERS, CA 92123	
7014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051	
2159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	TUCSON, AZ 85706	
0088	MOSTEK CORP.	1400 UPFIELD DR.	CARROLLTON, TX 75006	
0434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304	
0579	LITRONIX INC.	19000 HOMESTEAD RD.	CUPERTINO, CA 95014	
6289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247	
7668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713	
8361	GENERAL INSTRUMENT CORP.			
0001	OPTO ELECTRONICS DIV.	3400 HILLVIEW AVE	PALO ALTO, CA 94384	
9660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705	
9821	CENTRALAB INC	7158 MERCHANT AVE	EL PASO, TX 79915	
3021	SUB NORTH AMERICAN PHILIPS CORP	Tro menonini me		
1034	BLILEY ELECTRIC CO.	2545 W. GRANDVIEW BLVD.	ERIE, PA 16512	
1590	CENTRALAB ELECTRONICS, DIV. DF	2013 II. GIRING FILIT DETT.	2	
1330	GLOBE-UNION, INC.	PD BDX 858	FORT DODGE, IA 50501	
4970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093	
5042	TRW ELECTRONIC COMPONENTS, IRC FIXED	230 107.7712. 0. 111	***************************************	
3042	RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108	
9727	C-W INDUSTRIES	550 DAVISVILLE RD.,P O BOX 96	WARMINISTER, PA 18974	
0009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077	
2389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630	
	MALLORY CAPACITOR CO., DIV. OF	3029 E. WASHINGTON STREET	O. HOMOO, IL OUDOO	
0201	P. R. MALLORY AND CO., INC.	P. O. BOX 372	INDIANAPDLIS, IN 46206	
1697		P. O. BOX 5/2	COLUMBUS, NE 68601	
1637 6733	DALE ELECTRONICS, INC. SAN FERNANDO ELECTRIC MFG CO	1501 FIRST ST	SAN FERNANDO, CA 91341	

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	Tektronix	onix Serial/Model No.				
Dist Birm		Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
ki No.	Part No.	Ē11	Dacoui	Name & Description	COGE	Will Fait Humber
			40.00			670 640 . 6
-1	672-0424-01	B010100	B010156	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-01
1	672-0424-00	B010157	B032859	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-00
.1	672-0424-02	B032860	B032869	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-02
.1	672-0424-03	B032870		CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-00
2	670-3133-00	B010100	B010156	CKT BOARD ASSY:DISPLAY	80009	670-3133-00
2	670-3133-01	B010157	B032859	CKT BOARD ASSY:DISPLAY	80009	670-3133-01
		DDD0000		OUT DO LOD LOOV SIGN AV	05500	670 2422 02
2	670-3133-02	B032860		CKT BOARD ASSY:DISPLAY	80009	670-3133-02
.3	670-3602-00			CKT BOARD ASSY:TIME BASE	80009	670-3602-00
13				(OPTION 01 ONLY)		
:10	283-0204-00			CAP.,FXD,CER Dt:0.01UF,20%,50V	96733	R2676
10				(DPTION 01 ONLY)		
.00	000 0000 00			CAD EVE CED BLO THE 20W FORM	56289	3C37X7R104M500B
102	283-0008-00		m800000	CAP, FXD, CER DI:0.1UF,20%,500V		
104	281-0503-00	B010100	B032869	CAP, FXD, CER DI:8PF, + 1-0.5PF, 500V	59660	0301-080-COHO-80
104	281-0592-00	B032870		CAP.,FXD,CER DI:4.7PF, + /-0.5PF,500V	59660	0301080COH0479 D
106	281-0519-00			CAP.,FXD,CER DI:47PF,+/-4.7PF,500V	59660	308-000C0G0470K
116	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	04222	7027-C0G-330J
120	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
	000 0000 00			CAD EVE CED DISCAULE - DE COM. 1912	71590	20DU66B104Z
121	283-0023-00			CAP.,FXD,CER DI:0.1UF, +80-20%,12V		
128	290-0535-00			CAP,,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
144	283-0002-00			CAP.,FXD,CER DI:0.01UF, +80-20%,500V	59821	SDDH69L103Z
167	281-0781-00			CAP.,FXD,CER DI:68PF,10%,500V	59660	301-000-T3D0680K
167	*****			(STANDARD ONLY)		
170	281-0782-00			CAP.,FXD,CER DI.33PF,10%,500V	59660	301-000N4700330K
170				(STANDARD ONLY)	7.4470	400 0555 075
172	281-0131-00			CAP., VAR, AIR DI: 2.4-24.5PF, 250V	74970	189-0509-075
172				(STANDARD DNLY)		
190	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
205	283-0080-00			CAP.,FXD,CER DI:0.022UF, +80-20%.25V	59821	2DDU60E223Z
235	283-0002-00	B010100	B036569	CAP.,FXD,CER DI:0.01UF.+80-20%,500V	59821	SDDH69L103Z
.000	000 0524 00	0000570		CAP.,FXD.ELCTET:1UF.20%,35V	56289	196D105X0035HA1
235	290-0534-00	B036570				
240	290-0534-00			CAP.,FXD,ELCTLT: 1UF,20%,35V	56289	196D105X0035HA1
250	283-0023-00			CAP.,FXD.CER DI;0.1UF,+80-20%,12V	71590	2DDU66B104Z
255	283-0000-00			CAP,,FXD,CER DI:0.001UF, + 100-0%,500V	59660	831610Y5U0102P
270	283-0000-00			CAP.,FXD,CER DI:0.001UF, + 100-0%.500V	59560	831610Y5U0102P
276	283-0000-00			CAP.,FXD,CER DI:0.001UF, + 100-0%,500V	59660	831610Y5U0102P
	000 0000 00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
282	283-0000-00					831610Y5U0102P
288	283-0000-00			CAP.,FXD,CER DI:0.001UF, +100-0%,500V	59660	
294	283-0023-00			CAP.,FXD,CER DI:0.1UF, +80-20%,12V	71590	2DDU66B104Z
300	283-0001-00			CAP,,FXD,CER DI:0.005UF,+100-0%,500V	59821	2DDH61L502P
310	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	59660	301000X5U471M
315	283-0002-00			CAP.,FXD,CER DI:0.01UF, +80-20%,500V	59821	SDDH69L103Z
225	202 0002 00	0010100	poseceo	CAP.,FXD.CER DI:0.01UF,+80-20%,150V	59821	2DDH66J103Z
325	283-0003-00	B010100	B036569			
325	283-0065-00	B036570		CAP.,FXD,CER 0I:0.001UF,5%,100V	59660	0835-591Y5EO102J
340	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
405	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
408	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
415	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
400	000 0000 00			CAR EVO CER DIO VIIE / PO SON 1912	71 590	2DDU66B104Z
420	283-0023-00			CAP.,FXD.CER DI:0.1UF. + 80-20%,12V		
421	283-0023-00			CAP, FXD, CER DI:0.1UF, +80-20%, 12V	71590	2DDU66B104Z
425	283-0081-00			CAP, FXD, CER DI:0.1UF, +80-20%,25V	59821	2DDU69E104Z
435	290-0536-00			CAP.,FXD,ELCTLT:10UF.20%,25V	90201	TDC106M025FL
R108	152-0141-02			SEMICOND DVC.DI:SW.SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)

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	Tektroniy	Tektronix Serial/Model No.			Mfr	
Ckt No.	Part No.	Ell	Dscont	Name & Description	Code	Mir Part Number
CKI NO.	Fart No.	6.11	USCOM	Traine a Description	0000	terri i dit rediriça
00101				SEMICOND DVC.DI:SW.St,30V.150MA.30V.DO-35	12969	NDP0263 (1N4152)
CR161	152-0141-02			SEMICOND DEVICE:GERMANIUM.75V.60MA	14433	G1409
CR181	152-0008-00					
CR210	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
GR212	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR220	152-0141-02			SEMICOND DVC,DI;SW,SI,30V,159MA,30V,DO-35	12969	NDP0263 (1N4152)
CR225	152-0141-02			SEMICOND DVC,DI;SW,SI,38V,158MA,30V,DO-35	12969	NDP0263 (1N4152)
CR226	152-0008-00			SEMICOND DEVICE:GERMANIUM,75V,60MA	14433	G1409
CR235	152-0141-02			SEMICOND DVC.DI:SW.SI,30V.150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR240	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DD-35	12969	NDP0263 (1N4152)
CR245	152-0141-02			SEMICOND DVC, DI: SW, SI, 30V, 150MA, 30V, DO-35	12969	NDP0263 (1N4152)
CR246	152-0141-02			SEMICDND DVC.DI:SW,SI,30V,150MA,30V,DD-35	12969	NDP0263 (1N4152)
CR247	152-0141-02			SEMICOND DVC,DI;SW.SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR255	152-0141-02			SEMICDND DVC,DI:SW,SI,36V,158MA,30V,DO-35	12969	NDP0263 (1N4152)
	152-0141-02			SEMICDND DVC.DI:SW.SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR257						
CR320	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR322	152-0141-02			SEMICDND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR325	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
DS250	150-1001-01			LAMP,LED:RED,2V,100MA	50434	HLMP-3200
DS350	150-1018-00	B010100	B032859	LAMP, LED: RED, NUMERIC	50579	DATA-LIT 10A
DS350	150-1037-00	B032860		LAMP, LED, ROOUT: 7 SEGMENT, LH DECIMAL, DRANGE	58361	03409/MAN36202
DS355	150-1018-00	B010100	B032859	LAMP, LED: RED, NUMERIC	50579	DATA-LIT 10A
DS355	150-1037-00	B032860		LAMP, LED, ROOUT: 7 SEGMENT, LH DECIMAL, DRANGE	58381	03409/MAN36202
DS360	150-1018-00	8010100	8032859	LAMP, LED: RED, NUMERIC	50579	DATA-LIT 10A
DS360	150-1037-00	B032860	0002033	LAMP, LED.RDOUT: 7 SEGMENT, LH DECIMAL, DRANGE	58361	03409/MAN36202
					58530	
DS365	150-1018-00	B010100	B032859	LAMP, LED: RED, NUMERIC	50579	DATA-LIT 10A
DS365	150-1037-00	B032860		LAMP, LED, RDOUT: 7 SEGMENT, LH DECIMAL DRANGE	58361	03409/MAN36202
DS370	150-1018-00	8010100	B032859	LAMP, LED: RED. NUMERIC	50579	DATA-LIT 10A
DS370	150-1037-00	B032860		LAMP, LED, RDOUT: 7 SEGMENT, LH DECIMAL, ORANGE	58361	03409/MAN36202
DS375	150-1001-01			LAMP, LED: RED, 2V, 100MA	50434	HLMP-3200
J100	131-0955-00			CDNN.RCPT.ELEC:BNC.FEMALE	13511	31-279
L340	108-0317-00			CDIL, RF, FIXED, 15UH	32159	71501M
Q110	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	22229	S2089
0114	151-0424-00			TRANSISTOR:SILICON,NPN	04713	SPS8246
2130	151-0221-00			TRANSISTOR: SILICON, PNP	04713	SPS246
D134	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
				TRANSISTORISILICON,NPN	04713	SPS8246
D140	151-0424-00			TRANSISTOR, SIEGON, NEW	04713	3530240
Q15 <b>0</b>	151-0424-00			TRANSISTOR: SILICON, NPN	04713	SPS8248
D 180	151-0341-00			TRANSISTOR:NPN,SI,TD-106	04713	SPS6919
O180				(STANDARD DNLY)		
O185	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
D195	151-0504-00	B010100	B029999	TRANSISTOR; SILICON, N-CHAN, UNDUNCTION	04713	SU392
Q195	151-0504-01	B030000		TRANSISTOR: SILICON,N-CHAN,UNIJUNCTION	04713	SU309
D 198	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
D 200	151-0302-00			TRANSISTOR: SILICON, NPN	07263	S038487
D204	151-0341-00			TRANSISTOR:NPN.SI.TO-106	04713	SPS6919
0210	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS8919
235	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
D233	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS8919
	484 654 45			TO ANGIOTOGINON OF TO ACC	04210	COCCOAD
0245	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
247	151-0342-00			TRANSISTOR: SILICON, PNP	07263	\$035928
260	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
264	151-0341-00			TRANSISTOR:NPN,SI,TD-106	04713	SP\$6919
D300	151-0341-00			TRANSISTO:R:NPN.SI,TO-106	04713	SP\$6919
0310	151-0341-00			TRANSISTOR: NPN,SI,TO-106	04713	SPS6919

6-4 REV DEC 1984

0350 0355 0360 0365 0370	Tektronix Part No. 151-0301-00	Serial/Mod Eff	Dscont	Name & Description	Mfr Code	Mfr Part Numbe
350 355 360 365	151-0301-00					
355 360 365						
355 360 365				TRANSISTOR:SILICON,PNP	27014	2N2907A
360 365				TRANSISTOR:SILICON,PNP	27014	2N2907A
365	151-0301-00				27014	2N2907A
	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
370	151-0301-00			TRANSISTOR:SILICON,PNP		
	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
425	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
428	151-0302-00			TRANSISTOR: SILICON, NPN	07263	S038487
10	304-0681-00			RES.,FXO,CMPSN:680 OHM,10%,1W	01121	GB6811
10				(OPTION 01 ONLY)		
11	315-0511-00			RES.,FXD,CMPSN;510 OHM,5%,0.25W	01121	CB5115
11				(OPTIOH 01 ONLY)		
12	315-0510-00			RES.,FXO,CMPSN:51 OHM,5%,0.25W	57668	NTR25J-E51E0
				(ORTION ALONI VI		
12	245 2512 66	0010100	Dogges	(OPTION 01 ONLY)	57668	NTR25J-E51E0
100	315-0510-00	B010100	B032869	RES.,FXO,CMPSN:51 OHM.5%.0.25W		GB5105
100	303-0510-00	B032870		RES.,FXD,CMPSN:51 OHM.5%.1W	01121	
102	315-0330-00			RES.,FXD,CMPSN:33 OHM.5%,0.25W	01121	CB3305
106	323-0385-00			RES.,FXD,FtLM:100K OHM,1%,0.50W	75042	CECTO-1003F
108	322-0621-00			RES.,FXD.FILM:900K OHM,1%,0.25W	75042	CEBT0-9003F
110	315-0301-00			RES.,FXD,CMP\$N:300 OHM,5%,0.25W	57668	NTR25J-E300E
114	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
	315-0101-00			RES.,FXO,CMPSN:100 OHM,5%,0.25W	57868	NTR25J-E 100E
116				RES.,FXO,CMPSN:110 OHM,5%,0.25W	57668	NTR25JE110E
117	315-0111-00				01121	CB9105
120	315-0910-00			RES.,FXO,CMPSN:91 OHM,5%,0:25W		
123	315-0151-00			RES.,FXO,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150É
125	311-0091-00			RES., VAR, NONWIR: 1K OHM, 10%, 0.50W	01121	W-3063E
127	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
130	315-0112-00			RES.,FXD.CMPSN:1.1K OHM,5%.0.25W	01121	CB1125
134	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	57666	NTR25J-E51E0
136	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
139	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
				RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
140	315-0511-00				57668	NTR25J-E39E0
144	315-0390-00			RES.,FXD,CMPSN:39 OHM,5%,0 25W		
146	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J E470E
150	315-0511-00			RES.,FXO.CMPSN:510 OHM,5%,0.25W	01121	CB5115
152	315-0471-00			RES.,FXO,CMPSN:470 OHM,5%.0.25W	57668	NTR25J-E470E
154	315-0270-00			RES.,FXD,CMPSN:27 OHM.5%,0.25W	01121	CB2705
160	315-0221-00			RES.,FXO,CMPSN:220 OHM,5%,0.25W	57668	NTR25J E220E
165	316-0186-00			RES.,FXO,CMPSN:18M OHM,10%,0.25W	01121	CB1861
165	***************************************			(STANOARO OHLY)		
167	316-0126-00			RES.,FXD,CMP\$N:12M OHM,10%,0.25W	01121	CB1281
				(STANDARD ONLY)		
167 170	315-0243-00			RES.,FXD,CMP\$N:24K OHM,5%.0.25W	57668	NTR25J-E24K0
170				(STANOARO ONLY)	£7000	NTOSE : FALL
175	315-0512-00			RES.,FXD.CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
176	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%.0.25W	57668	NTR25J-E05K1
177	315-0512-00			RES.,FXO,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
179	315-0153-00			RE\$.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
180	315-0272-00			RES.,FXO,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
180				(STANOARD DNLY)		
181	315-0103-00			RES.,FXO,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
182	315-0512-00			RES.,FXO,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
		B010100	B036569	RES.,FXO,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
187	315-0512-00	B010100	D030303		57668	NTR25J-E07K5
187 190	315-0752-00 311-1342-00	B036570		RES.,FXD,CMPSN:7.5K OHM,5%,0.25W RES.,VAR,NONWIR:PNL,508K OHM,0 5W,W/SW	16546	BA206-014
				(PART OF \$190)		

Ck1 No.	TERMOUN	Tektronix Senal/Model No.			Mfr	
	Part No.	Eff	Dscont	Name & Description	Code	Mfr Part Number
	,					
R195	315-0100-00	B010100	B036569	RES.,FXD,CMPSN.10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R195	315-0200-00	B036570	000000	RES.,FXD,CMPSN:20 OHM,5%,0.25W	01121	CB2005
		B030370		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A 198	315-0102-00				57668	NTR25JE01K0
R200	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25J-E05K1
R203	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W		
R204	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0 25W	57668	NTR25J-E10K0
R205	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
R206	315-0512-00	B036570		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R207	315-0103-00	50000.0		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J E10K0
R208	315-0102-00			RES. FXD.CMPSN:1K OHM,5%,0,25W	57668	NTR25JE01K0
R210	315-0103-00			RES, FXD, CMPSN: 10K OHM, 5%, 0.25W	57668	NTR25J-E10K0
R210	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
7212	313.0302.00			TIEG., TAB, GITT GIT. GITTING TO THE TOTAL GITTING THE TOTAL GITTING TO THE TOTAL GITTING TO THE TOTAL GITTING TO THE TOTAL GITTING TO	• • • • • • • • • • • • • • • • • • • •	
R215	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,D.25W	57868	NTR25J-E05K1
A220	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R 225	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57688	NTR25J-E05K1
9226	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A227	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R230	315-0512-00			RES FXD,CMPSN:5.1K OHM,5%.0.25W	57668	NTR25J-E05K1
						LTC005 - E 400E
R232	315-0101-00			RES.,FXD.CMPSN:100 OHM,5%,0.25W	57668	NTR254E 100E
A235	315-0102-00			RES., FXD, CMPSN:1K OHM, 5%.0.25W	57668	NTR25JE01K0
R240	315-0103-00			RESFXD,CMPSN:10K OHM,5%,0:25W	57668	NTR25J-E10K0
R243	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%.0 25W	57668	NTA25J-E05K1
R245	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57 <b>668</b>	NTR25J-E05K1
R247	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
				DEC TUD OLIGICAL LIGHT CHIEF EN O SEIN	57668	NTR25J-E470K
R250	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0 25W	01121	CB5115
R252	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W		
R255	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%.0 25W	01121	CB3035
R257	315-0102-00	B010100	B036569	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R257	315-0562-00	B036570		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
R260	315-0102-00	B010100	B036569	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R2 <b>60</b>	315-0562-00	B036570		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J ED5K6
		D030310		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R262	315-0102-00				57668	NTR25JE01K0
R264	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,025W	01121	CB5115
A268	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%.0.25W		-
A300	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A304	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,D.25W	57668	NTA25J-E33K0
A306	315-0334-00			RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
A310	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A315	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
	315-0102-00			RES, FXD, CMPSN:1K OHM, 5%, 0.25W	57668	NTR25JE01K0
A316	315-0102-00			RES.,FXD,CMPSN:1K OHM.5%,0.25W	57668	NTR25JE01K0
A317 A318	315-0102-00			RES, FXD, CMPSN:1K OHM, 5%, 0.25W	57668	NTR25JE01K0
1010	015-010-00					
R322	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	57668	NTR25J-E300E
A325	315-0512-00	8010100	B036569	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R325	315-0102-00	B036570		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R330	315-0750-00	9010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57688	NTR25J-E75E0
A330	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57688	NTR25J-E150E
A331	315-0750-00	8010100	B032859	RES.,FXD.CMPSN.75 OHM,5%,0.25W	57668	NTA254E75E0
0004	246 0464 00	0000000		RES.,FXD,CMPSN:150 OHM,5%,0 25W	57668	NTR25J-E150E
A331	315-0151-00	B032860	0000000		57668	NTR25J-E75E0
A332	315-0750-00	8010100	8032859	RES.,FXD.CMPSN:75 OHM,5%,0.25W		
A332	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A333	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A333	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R334	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR254 E75E0
R334	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E

	Tektronix	Serial/Mod	tel No.		Mir	
Ckt No.	Part No.	EH	Dscont	Name & Description	Code	Mfr Part Number
1335	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
1335	315-0151-00	B032860	DUDZUU	RES. FXD.CMPSN: 150 OHM,5%,0.25W	57668	NTR25J-E150E
1336	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%.0.25W	57668	NTR25J-E75E0
		B032860	5032039	RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
336	315-0151-00	BU3200U			57668	NTR25J-E 100E
340	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W		
1350	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0,25W	57668	NTR25JE01K0
351	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
355	315-0102-00			RES.,FXD,CMPSN;1K OHM,5%,0.25W	57668	NTR25JE01K0
356	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0,25W	01121	CB2715
360	315-0102-00			RESFXD.CMPSN:1K OHM.5%.0.25W	57668	NTR25JE01K0
	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
361	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
362	313-9312-00			723, PAD, CMP 311.3.111 OTM, 3 4, 0.2311	37000	14111230-203111
363	315-0301-00	Be10100	B032859	RES.,FXD,CMPSN:300 OHM,5%,0 25W	57668	NTR25J-E300E
363	315-0101-00	B032860		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
365	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%.0 25W	57668	NTR25JE01K0
366	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
370	315-0102-00			RESFXD.CMPSN:1K OHM.5%,0.25W	57668	NTR25JE01K0
370 371	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
	0.0.05.00			The state of the s		
375	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
400	304-0331-00			RES.,FXD,CMPSN:330 OHM,10%,1W	01121	GB3311
402	321-0225-00			RES.,FXD,FILM;2.15K OHM,1%,0.125W	91637	MFF1816G21500F
403	321-0260-00			RES,,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
405	308-0463-00			RES.,FXD,WW:0.3 OHM,1%,3W	91637	AS2B-A3000F T/A
40B	315-0162-00			RES.,FXD.CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
700	313-0102-00			TIEGHT AG, GITT GITT GITT GITT GITT GITT GITT GI		0-10-0
425	301-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%.0.5W	01121	EB2225
427	308-0685-00			RES.,FXD,WW:2.2 OHM,5%,2W	75042	BWH-28200J
428	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
430	315-0131-00			RES.,FXD,CMPSN:130 OHM,5%,0.25W	01121	CB1315
432	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
435	301-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.50W	57668	TR50J-E 510E
100	260-0816-00	B010100	B032869	SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF-126-0012A
100	260-1833-00	B032870		SWITCH, SLIDE: DPDT	82389	11P-1092
102	260-0723-00			SWITCH, SLIDE: DPDT.0.5A, 125VAC	79727	GF126-0028
160	260-0723-00			SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF126-0028
190				(PART OF R190)		
200	263-1031-00			SW CAM ACTR AS:FUNCTION	80009	263-1031-00
210	260-0723-00			SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF126-0028
235	260-1421-00			SWITCH, PUSH: 1 STA, MOMENTARY, NOH-SHORT	59821	2KAA010000512
245	260-0723-00			SWITCH, SLIDE: DPDT, 0.5A, 125VAC	79727	GF126-0028
10	156-0079-02			MICROCIRCUIT, DI: DECADE COUNTER, SCREENED	01295	SN7490A(NP3 OR .
10	****			(OPTION 01 OHLY)		
160	156-0410-00			MICROCIRCUIT, DI: COUNTER TIME BASE	50088	MK5009P
						*******
180	156-0041-05			MICROCIRCUIT, DI: DUAL D-FLIP FLOP	01295	SN7474
210	156-0079-02			MICROCIRCUIT, DI: DECADE COUNTER, SCREENED	01295	SN7490AINP3 OR
215	156-0058-02			MICROCIRCUIT, DI:HEX INVRTA, SCREENED	01295	SN7404
217	156-0041-05			MICROCIRCUIT, DI-DUAL D-FLIP FLOP	01295	SN7474
220	156-0180-04			MICROCIRCUIT, DI: OUAD 2-INPUT NAND GATE	01295	SN74S00NP3
255	156-0081-02			MICROCIRCUIT, DI: RETRIG MONOSTABLE MV, SCRN	80009	156-0081-02
					01000	CN7474
260	156-0041-05			MICROCIRCUIT, DI: DUAL D-FLIP FLOP	01295	SN7474
265	156-0030-00			MICROCIRCUIT, DI: OUAD 2 INPUT NAND GATE	01295	SN7400(N OR J)
270	156-0079-02			MICROCIRCUIT, DI: DECADE COUNTER, SCREENED	01295	SN7490A(NP3 OR
272	156-0040-02			MICROCIRCUIT, DI:OUAD LATCH, SCREENED	01295	SN7475(NP3 OR JE
274	156-0057-02			MICROCIRCUIT, DI: OUAD 2-INP NAND GATE, SCRN	01295	SN7401(NP3 OR JF
1276	156-0079-02			MICROCIRCUIT, DI: DECADE COUNTER, SCREENED	01295	SN7490A(NP3 OR -

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### Replaceable Electrical Parts—DC 504

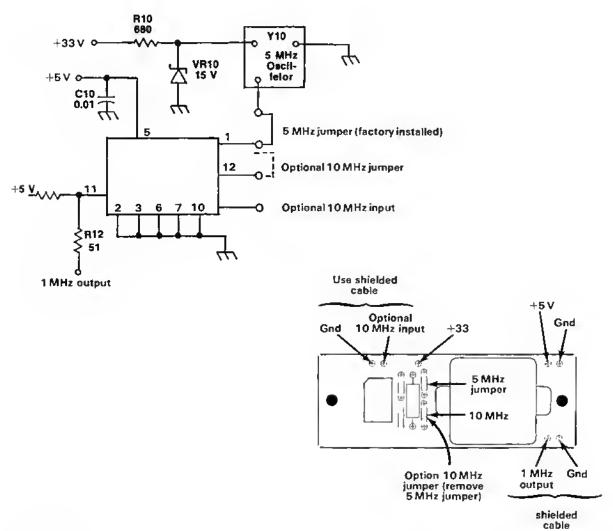
	Tektronix	Serial/N	fodel No.		Mfr	
Ckt_No.	Part No.	Eff	Dscont	Name & Description	Code	Mfr Part Number
U278	156-0040-02			MICROCIRCUIT, DI:QUAD LATCH, SCREENED	01295	SN7475(NP3 OR JP
U278	156-0057-02			MICROCIRCUIT.OI:QUAD 2-INP NAND GATE.SCRN	01295	SN7401(NP3 OR JP
	156-0079-02			MICROCIRCUIT.DI:DECADE COUNTER.SCREENEO	01295	SN7490A(NP3 OR J
U282 U284	156-0040-02			MICROCIRCUIT.DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
				MICROCIRCUIT, DI: QUAD 2-INP NANO GATE, SCRN	01295	SN7401(NP3 OR JP
U286 U288	156-0057-02 156-0079-02			MICROCIRCUIT, DI: OECADE COUNTER, SCREENED	01295	SN7490A(NP3 OR J
0200	130-007 3-02			Migridgingships. See See See See See See See See See Se	***	
U290	156-0040-02			MICROCIRCUIT, DI: QUAD LATCH, SCREENED	01295	SN7475(NP3 OR JP
U292	156-0057-02			MICROCIRCUIT, DI: QUAD 2-INP NAND GATE, SCRN	01295	SN7401(NP3 OR JP
U294	156-0482-01			MICROCIRCUIT, DI:PRESETTABLE DECADE CNTR.SCR	27014	DM74S196(NA+ OR
U296	156-0040-02			MICROCIRCUIT, DI: QUAD LATCH, SCREENED	01295	SN7475(NP3 OR JP
U298	156-0057-02			MICROCIRCUIT, DI: QUAD 2-INP NANO GATE, SCRN	01295	SN7401(NP3 OR JP
U310	156-0073-02			MICROCIRCUIT, DI:5-BIT SHIFT REGISTER, SCRN	01295	SN7496
U315	156-0165-02			MICROCIRCUIT, DI:OUAL 4 INP NOR GATE	01295	SN7425
U320	156-0128-01			MICROCIRCUIT, DI:BCD-TO 7 SEG DCDR/DRVR	80009	156-0128-01
U325	156-0093-02			MICROCIRCUIT.DI:HEX INV BUFFER.BURN-IN	01295	SN74LS00 (NP3)
U400	156-0071-00			MICROCIRCUIT.LI:VOLTAGE REGULATOR	04713	MC1723CL
VR10	152-0243-00			SEMICOND DEVICE: ZENER, 0.4W, 15V, 5%	14552	TD3810983
VR10				(OPTION 01 ONLY)		
VR110	152-0226-00			SEMICOND DEVICE: ZENER. 0.4W.5.1V.5%	14552	TD3810980
VR140	152-0226-00			SEMICOND DEVICE: ZENER, 0.4W, 5.1V, 5%	14552	TD3810980
VR146	152-0226-00			SEMICOND DEVICE: ZENER, 0.4W, 5.1V, 5%	14552	TD3810980
VR430	152-0280-00			SEMICOND DEVICE: ZENER, 0.4W, 6.2V, 5%	80009	152-0280-00
Y10	119-0262-00			OSCILLATOR, RF: XTAL CONTROLLED, 5 MHZ ADJ	71034	C214-3
Y10	*****			(OPTION 01 ONLY)		
Y160	158-0079-00			XTAL UNIT.QTZ:1 MHZ.+/-0.001%	00136	ORD BY DESCR
Y160				(STANDARD ONLY)		

# **OPTIONS**

Your instrument may be equipped with one or more options. This section describes those options, or directs the reader to where the option is documented.

# **OPTION 1**

Oplion 1 equips the DC 504 with a temperature compensated, 5 MHz crystel oscillator to obtain a highly stable and precise internet time base. This option includes an IC which may be connected a alther a divide-by-live (5 MHz oscillator) or a divide-by-ten (10 MHz oscillator).



REV. C JAN 1977

## DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

### Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).

Values less than one are in microfarads ( $\mu$ F).

Resistors = Ohms  $(\Omega)$ .

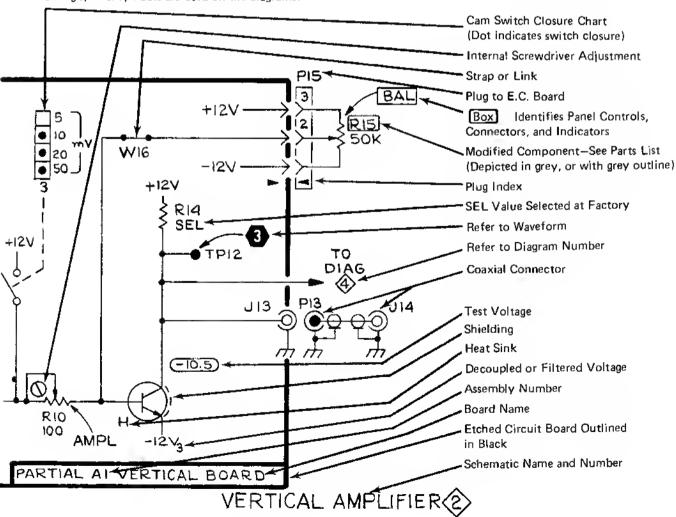
Symbols used on the diagrams are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

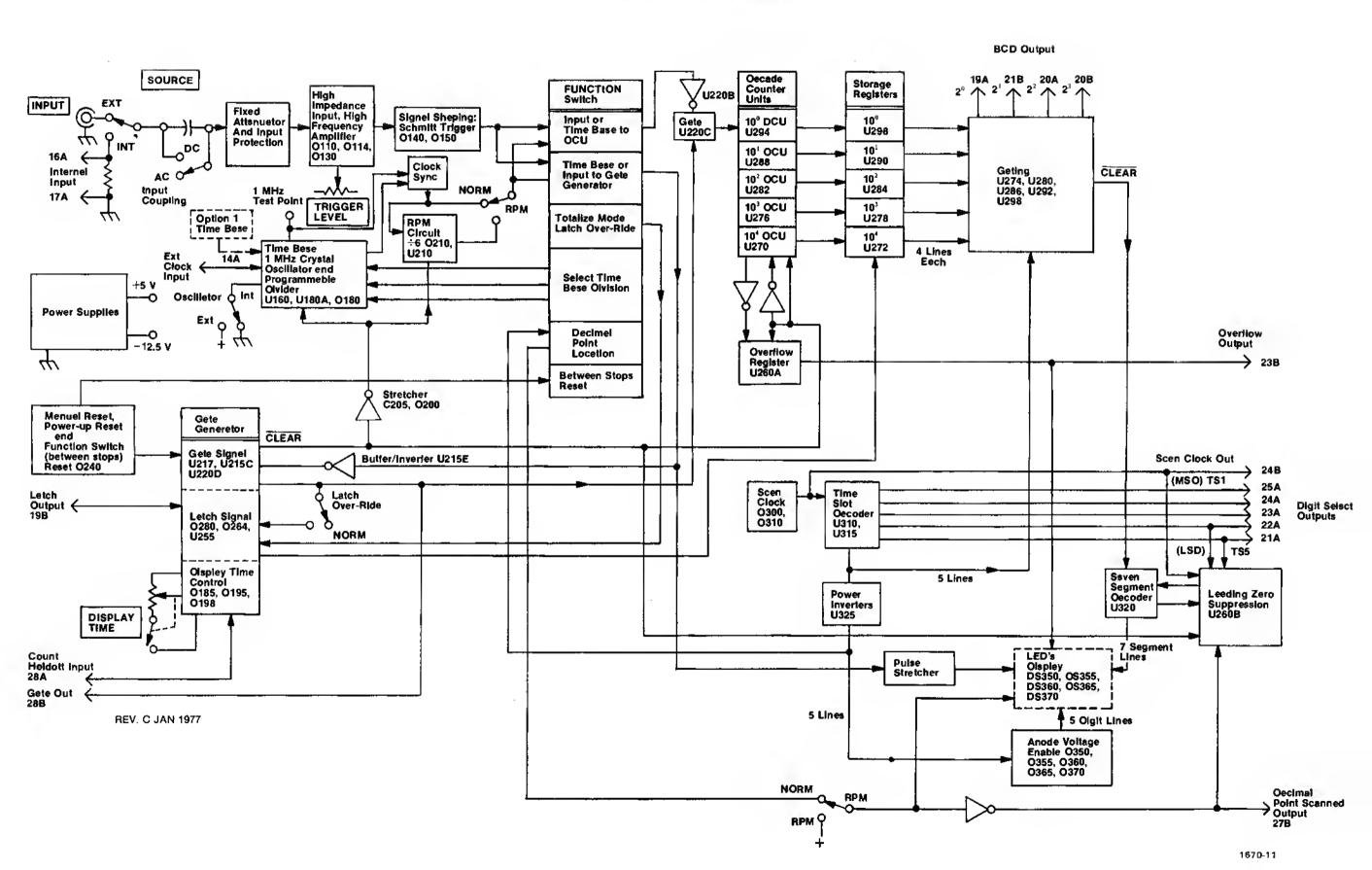
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

Α	Assembly, separable or repairable	н	Heat dissipating device (heat sink.	S	Switch or contactor
	(circuit board, etc.)		heat radiator, atc.)	Т	Transformer
AT	Attenuator, fixed or variable	HR	Heater	TC	Thermocouple
В	Motor	HY	Hybrid circuit	TP	Tast point
BT	Battery	J	Connector, stationary portion	U	Assembly, inseparable or non-repairable
C	Capacitor, fixed or variable	ĸ	Relay		(Integrated circuit, etc.)
CB	Circuit breaker	L,	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zenar diode, etc.)
DL	Detay line	P	Connector, movable portion	W	Wirastrap or ceble
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled	Y	Crystal
E	Spark Gap		rectifier	Z	Phase shifter
F	Fuse	R	Resistor, fixed or veriable		
FL	Filter	RT	Thermistor		

The following special symbols are used on the diagrams:



### **BLOCK DIAGRAM**



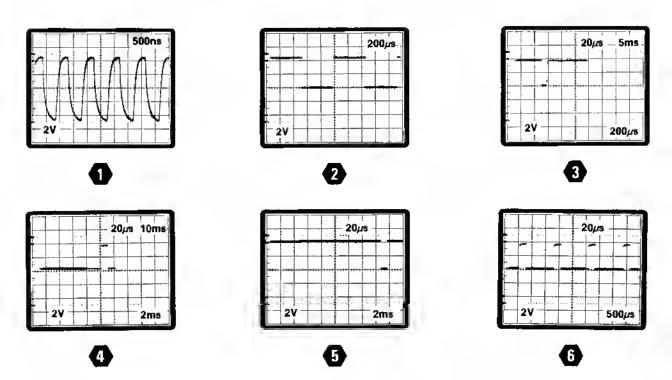
The voltages and waveforms shown on the diagrams were taken with a 1 MHz, 1 volt peak-to-peak sinewave input signal and the DC 504 front panel controls set as follows:

FUNCTION MHz 1 kHz RESOLUTION

SOURCE EXT

DISPLAY TIME midrange TRIGGER LEVEL midrange

in waveforms, ground reference is the center horizontal graticule line.



# INPUT-OUTPUT ASSIGNMENTS FOR PLUG-IN REAR INTERFACE CONNECTOR

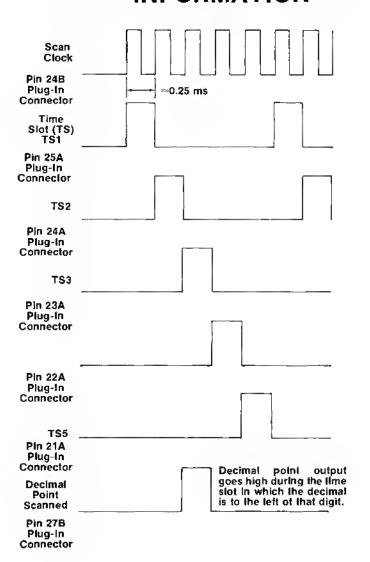
Remerka	Maximum Recom- mended Loeds	Active Level	Output Or Inpul	PIN 8		PIN A	Outpul or Input	Active Level	Maximum Recom- mended Loads	Remarks	
High During COUNTING Time	5 TTL	High	Gele-Out	26	] !	Żā	Count Holdoll Input	High	Fan-in <1		
Pull low to atop TOTALIZE (use open collector)	Must sink 5 mA (3 TTL)	Low	TOTALIZE START/STOP (Inpul)	28							
Nominal 0.25 ms Wide Pulse	24 TTL	High	Decimal Point Scenned Ontput	27		27					
				26		26	Reset Input/ Output	Low	Output: 6 TYL Input: 6 TTL or transistor to sink at least 15 mA		
				25	Ì	25	TS1 (MSD) Digil Select Dutpul				
Nominal 35 kHz	1 TTL	TTL Compatible	Scan Clock Out	24	j	24	TS2 Olgil Select Output				
	6 TTL	High	Overflow Dutput	23		23	TS3 Digit Select Output	High	4 TTL each	Nominel 0.25 me Wide Puise	
				22	Meesure- ment Berrier Stot	22	TS4 Olell Select Output				
_	6 TTL	High	BCO Oulpul 2	21		21	TSS (LSD) Dige Select Output				
	6 TTL	High	BCO Output (MSB) 6	26		20	4 BCD Oulput	High	6 TTL		
Nominal 10 µs Wide Pulse	10 TTL	High	Laich Outpul (Deta Good)	16		10	1 (LSB) BCO Output	High	O TTL		
				16		10					
				17		17	Internal Input Ground			50 ohm Nominal	
				16		16	Internal Input			Imput Impedance	
				14		15	Exi Clock Inpul	TTL Compelible (Internelly clamped to 0 V and +5 V)	Should awing between 0.4 V and +4 V to guarantes accurate aleving	User must connect shield jumper between two circuit board pads marked E.O. insids DC 504	
			25 VAC winding	13		13	25 VAC winding				REFER TO P
			→ 33.5 V filtered DC	12		12'	+ 33.5 V Illtered DC				LOCATION (
			Collector Lead of PNP Series-Peas	111		11'	Bese lead of PNP Series Pess				
			Transformer/ shield lead	10		10'	Emitter leed of PNP Series-Peas				
			±33.5 ¥ common ;	9.		9	±33.5 ¥ common return				
			-33.5 filtered DC	8"		a	33.5 V fillered OC				
			Collector Lead of NPN Series-Pass	7*	TM500 Barrier	7'	Emilter lead of NPN Series-Pass				
			No connection	6	5101	6.	Base lead of NPN Series-Pass				
		İ	17.5 VAC	5		5	17.5 VAC winding				
			winding 411.5 V common return	4		41	+11.5 V common return				
			+11.5 V common	3		4*	+11,5 V common return				
			+11.5 V filtered	2.		2	111.5 V filtered DC				
		:	25 VAC winding	1		5	25 VAC winding				
			arry	В	Rear- View of plug-in	A					

<sup>\*</sup>asignments listed for pine 14 – 136 and 18 – 138 are evallable in all power modules; however only those pine marked with an asterisk (\*) are used by the DC 504.

LSD — Least significant digit, MSD — Most significant digit; LSB — Least significant bit, MSB — most significant bit.

<sup>&#</sup>x27;Pin 26A tevel goes tow only when: (a) Front-panel RESET pushbutton is pushed; (b) During power up reset; (c) Change in position of FUNCTION stwich. It does not go tow when the DC 504 clears itself for snother count.

# DIGIT SELECT OUTPUT, DECIMAL POINT SCANNED OUTPUT AND SCAN CLOCK OUT INTERFACE INFORMATION

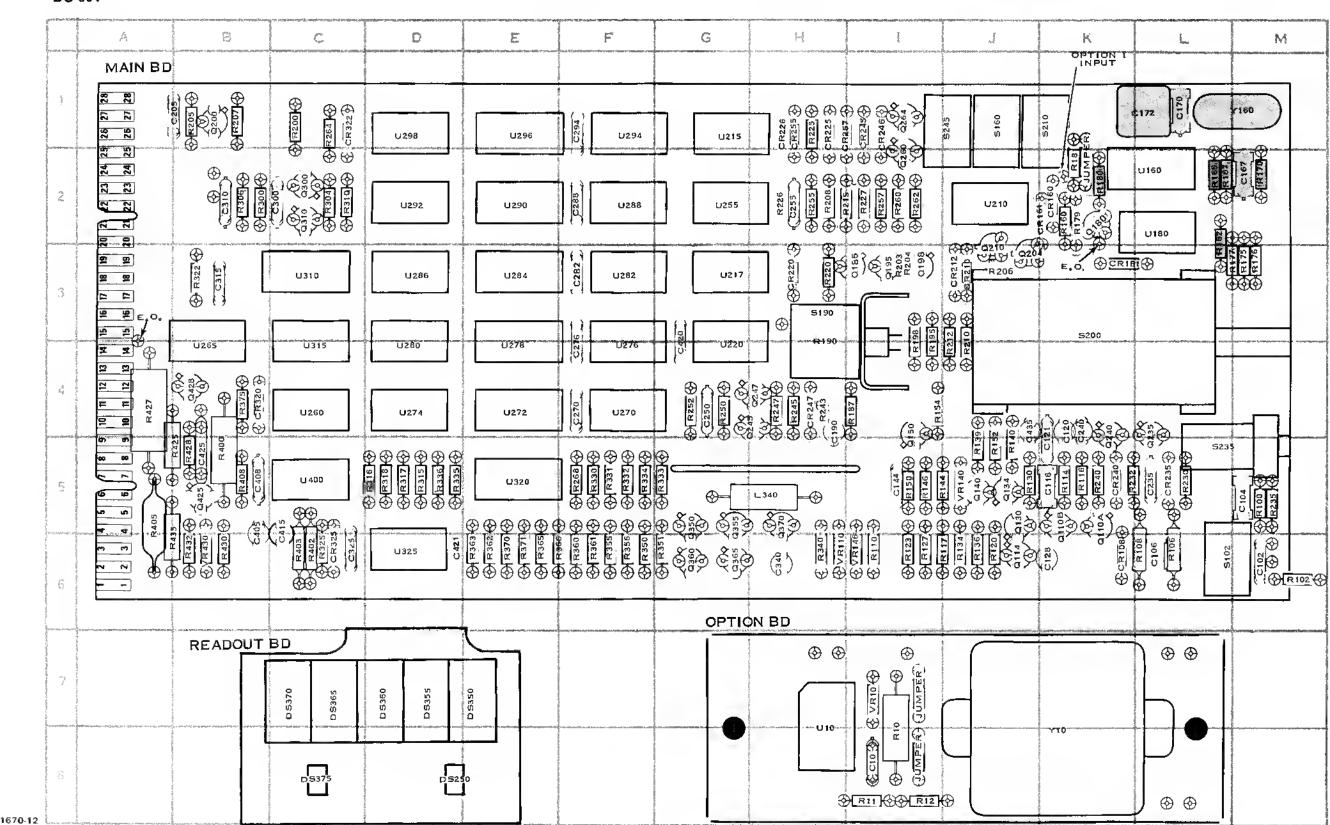


# DC 504

#### NOTE:

Example shown with decimal point scanned going high in TS3 will result in a display ot \_\_.XXX

1670-15

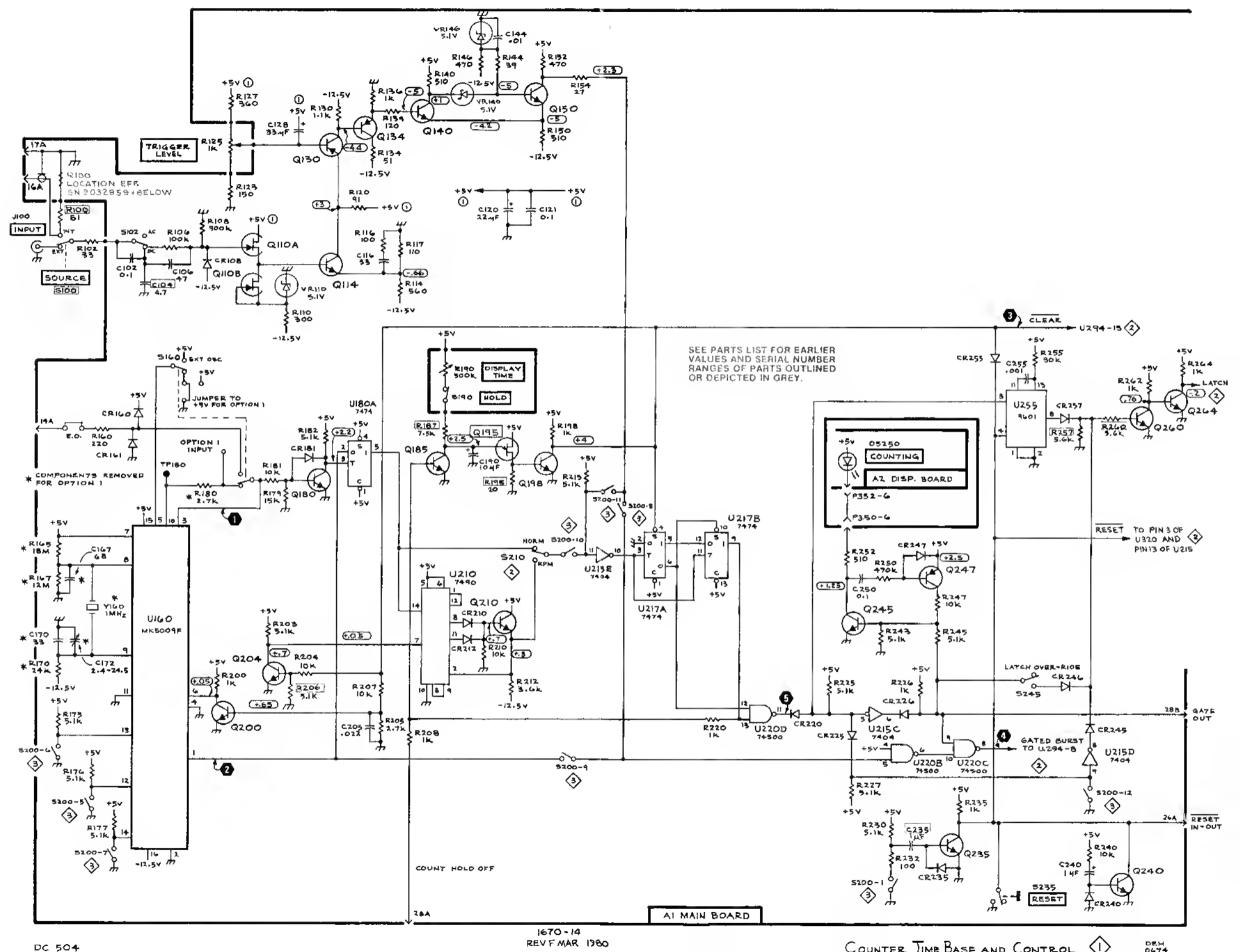


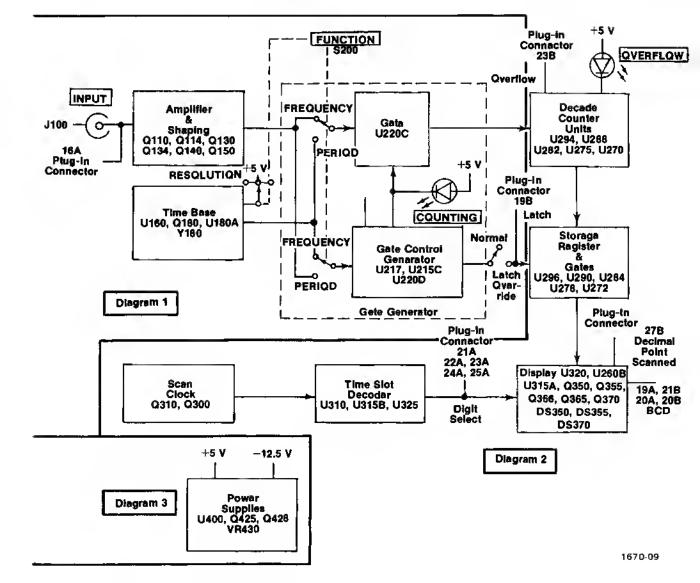
CKT	GRID	CKT	GRID	CKT	GRID	СКТ	GRID	CKT	GRI
ND	LOC	NO	LDC	NO	LOC	NO	LOC	NO	LOC
C102†	M6	D6250	D6	R140	J5	R315	Q5	U260	C4
C104†	M5	DS350	E7	R144	J5	FI318	D5	U265	B4
C106	L6	Q\$355	D7	R146	15	R317	Q5	U270	F4
C116	K5	DS360	D7	R150	15	R318	D5	U272	E4
C120	K4	DS365	C7	R152	J5	R322	В3	U274	Q
C121	K5	DS370	C7	R154	14	R325	C6	U278	F4
C128	K6	DS375	C6	R160	K2	R330	F5	U278	E
C144	15			R165	L2	R331	F5	U260	Q
C167	M2	L340	H5	R167	L2	R332	F5	U282	F
C170	L1			R170	M2	R333	G5	U264	E
C172	L1	Q110	K5	R175	M3	R334	F5	U286	D:
C190	H4	Q114	J6	R176	M3	R335	D5	U288	F
C205	B1	Q130	J5	R177	MЗ	R336	Q5	U290	E:
C235	L5	Q134	J5	R179	K2	R340	H6	U292	D:
C240	K4	Q140	J5	R160	K2	R350	F6	U294	F
C250	G4	Q150	15	R161	K2	R351	G6	U296	E
C255	H2	Q160	К2	R162	L3	R355	F6	U298	Q
C270	F4	Q185	13	R167	14	R356	F6	U310	C
C276	F4	Q195	13	R190	H4	R360	F6	U315	C
C282	F3	Q198	13	R195	14	R361	F6	U320	E
C286	F2	Q200	B1	R198	14	R382	E6	U325	D
C294	F1	Q209	J3	R200	C1	R363	E6	U400	С
C300	C2	Q210	13	R203	13	R385	E6		
C310	B2	Q235	L5	R204	13	R366	F6	VR110	Н
C315	B3	Q240	K5	R205	B1	R370	<b>E</b> 6	VR140	J
C325	C6	Q245	H4	R206*	J3	R371	E6	VR146	16
C340	H6	Q247	H4	R207	B1	R375	B4	VR430	В
C405	B5	Q260		R206	H2	R400	B5		
C408	B5	Q264	11	R210	J4	R402	C6	Y160	M
C415	C5	Q300	C2	R212	J4	R403	C6		
C420	G4	Q310	C2	R215	12	R405	A5		
C421	E6	Q350	G5	R210	H3	R408	B5	Option 1	
C425	B5	O 355	G5	R225	H1	R425	B5		
C435	J4	Q360	G6	R226	H2	R427	A4	C10	18
- 1.00	- 1	Q365	G6	R227	12	R428	B5	R10	16
CR108	К6	Q370	H5	R230	L5	R430	B6	R11	16
R160	K2	Q425	B5	R232	L.5	R432	В6	R12	H
CR161	K2	Q428	B4	R235	M5	R435	B5	U10	H
CR161	КЗ			R240	K5			VR10	16
CR210	J3	R1001	M5	R243	H4	S102	L6	Y10	K
R212	73	R102	M6	R245	H4	S160	J1		
R220	H3	R106		R247	H4	S190	H4		
R225	H1	R106	L6	R250	G4	\$200	K4		
R226	H1	R110	16	R252	G4	S210	J1		
CR235	L5	R114	K5	R255	H2	S235	Ł5		
R240	K5	R116	K5	R257	12	S245	J1		
CR245	11	R117	J6	R260	12				
R246	I1	R120	16	R262	12	U180	L2		
R247	H4	R123	16			U160	L2		
R255	H1	R123	16	R264 R288	C1	U210	J2		
R257	11	R127			F5	U215	G1		
R320	1		J5	R300	B2	U217	G3		
	B4	R134	J6	R304	C2	U220	G4		
R322	C1	R136 R139	J6	R306	B2	U255	G2		

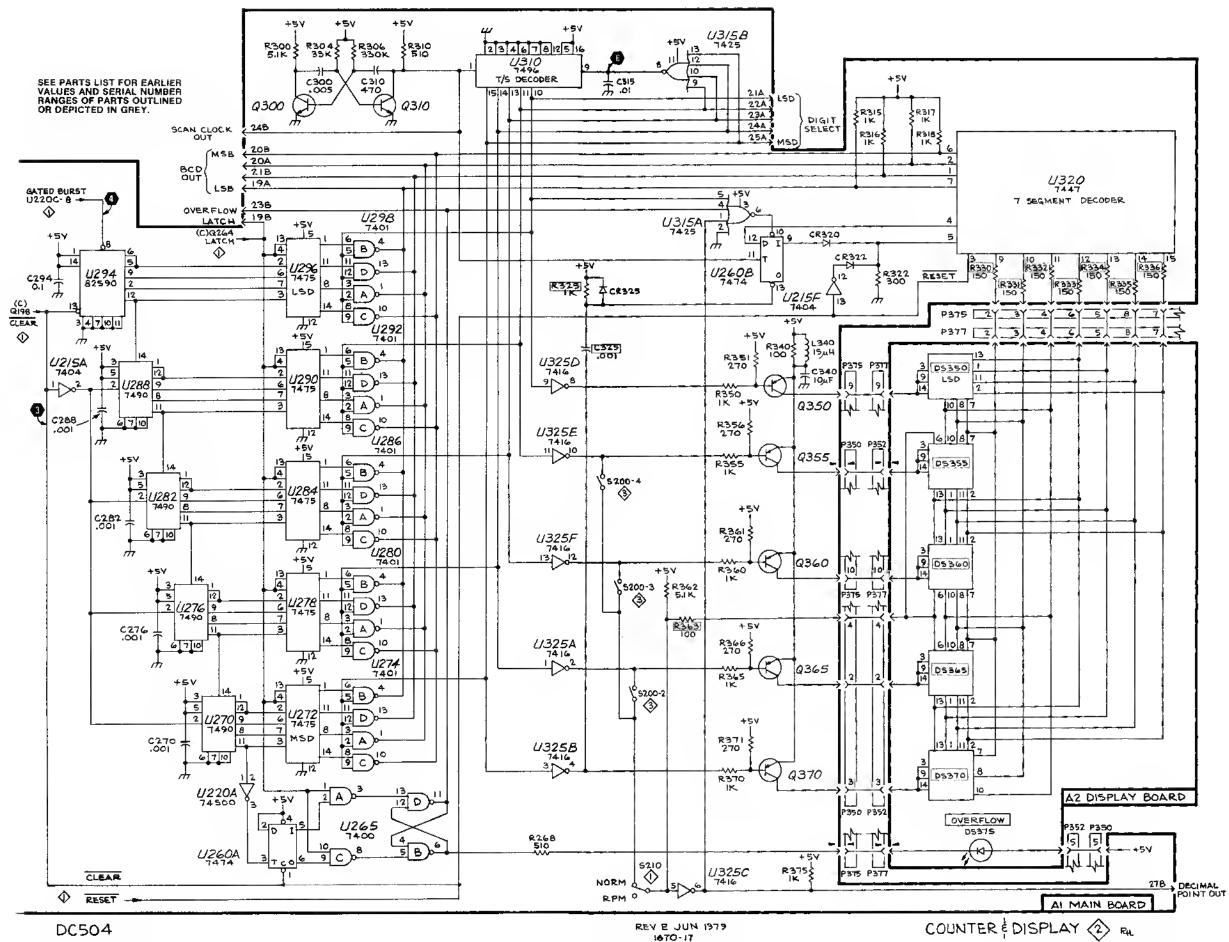
<sup>\*</sup> See Parts List for serial number ranges.

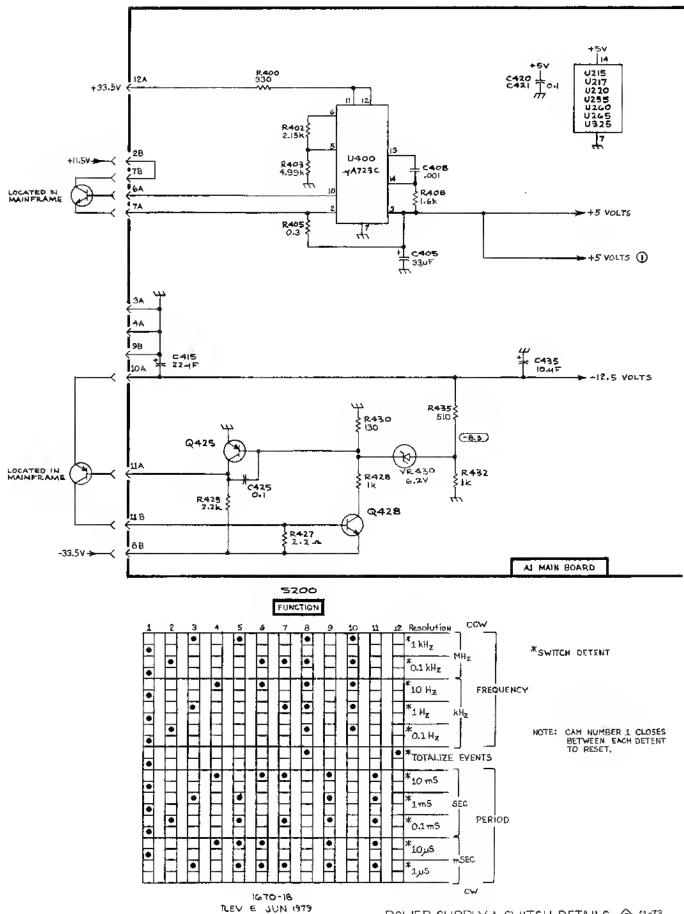
<sup>†</sup>Located on back of board

NOTE: R100 relocated on S100









# REPLACEABLE MECHANICAL PARTS

### PARTS ORDERING INFORMATION

Reptacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the tollowing information in your order: Part number, instrument type or number, serial number, and modification number it applicable.

It a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, it any, is tocated at the rear of this manual

### SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
oox	Part removed after this serial number

### FIGURE AND INDEX NUMBERS

ttems in this section are referenced by figure and index numbers to the illustrations.

### INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5

Name & Description

Assembly and/or Component Attaching parts for Assambly and/or Component

Detail Part of Assembly and/or Component Attaching parts for Detail Part

. . . \* . . .

Parts of Detail Part Attaching parts for Perts of Detail Part

Attaching Parts always appear in the same indentation as the item it mounts, white the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol . . . indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

#### ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

### **ABBREVIATIONS**

-	INCH	ELCTRN	ELECTRON	1N	INCH	SE	SINGLE END
	NUMBER SIZE	ELEC	ELECTRICAL	INCANO	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICONO	SEMICONOUCTOR
ADPTR	AOAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLO	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLOR	LAMPHOLDER	SHLDA	SHOULOERED
AL	ALUMINUM	EOPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	St	SLICE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLELKO	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	St.VG .	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE		SPA	SPRING
BO	BOARD	FLTR	FILTER	OBO	OADER BY DESCRIPTION	SO	SOUARE
BAKT	BRACKET	FR	FRAME OF FRONT	00	OUTSIDE DIAMETER	5\$T	STAINLESS STEEL
BAS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXO	FIXEO .	PL	PLAIN or PLATE	T	TUBÉ
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	ACPT	RECEPTACLE	TPO	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPPESSION	RES .	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGO	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNA	RETAINER	W/	WITH
CRT	CATHOOE RAY TUBE	ID	INSIDE CIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	OEGREE	IOENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	ORAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

### CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

Mir Code	Manufacturer	Address	City, State, Zip
000CY	NORTHWEST FASTENER SALES, INC.	7923 SW CHARUS ORIVE	BEAVERTON, OR 97005
0779	AMP, INC.	P.O. BOX 3508	HARRISBURG, PA 17105
8261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GAROEN GROVE, CA 92642
9922	BURNOY CORPORATION	RICHAROS AVENUE	NORWALK, CT 06852
3511	AMPHENOL CARORE OIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
2526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
5722	USM CORP., PARKER-KALON FASTENER DIV.		CAMPBELLSVILLE, KY 42718
7668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
3743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45208
8189	ILLINOIS TOOL WORKS, INC.		
	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
8471	TILLEY MFG. CO.	900 INOUSTRIAL RO.	SAN CARLOS, CA 94070
9136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
9807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
0009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
3385	CENTRAL SCREW CO.	2530 CRESCENT OR.	BROADVIEW, IL 60153
6113	MICRODOT MFG. INC.,		
	CENTRAL SCREW - KEENE DIV.	149 EMERALD ST.	KEENE, NH 03431
7308	N. L. INOUSTRIES, INC., SOUTHERN SCREW		
	DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
0484	ITT, SURPRENANT DIV.	172 STERLING STREET	CLINTON, MA 01510
3907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORO, IL 61101

8-2 REV OEC 1984

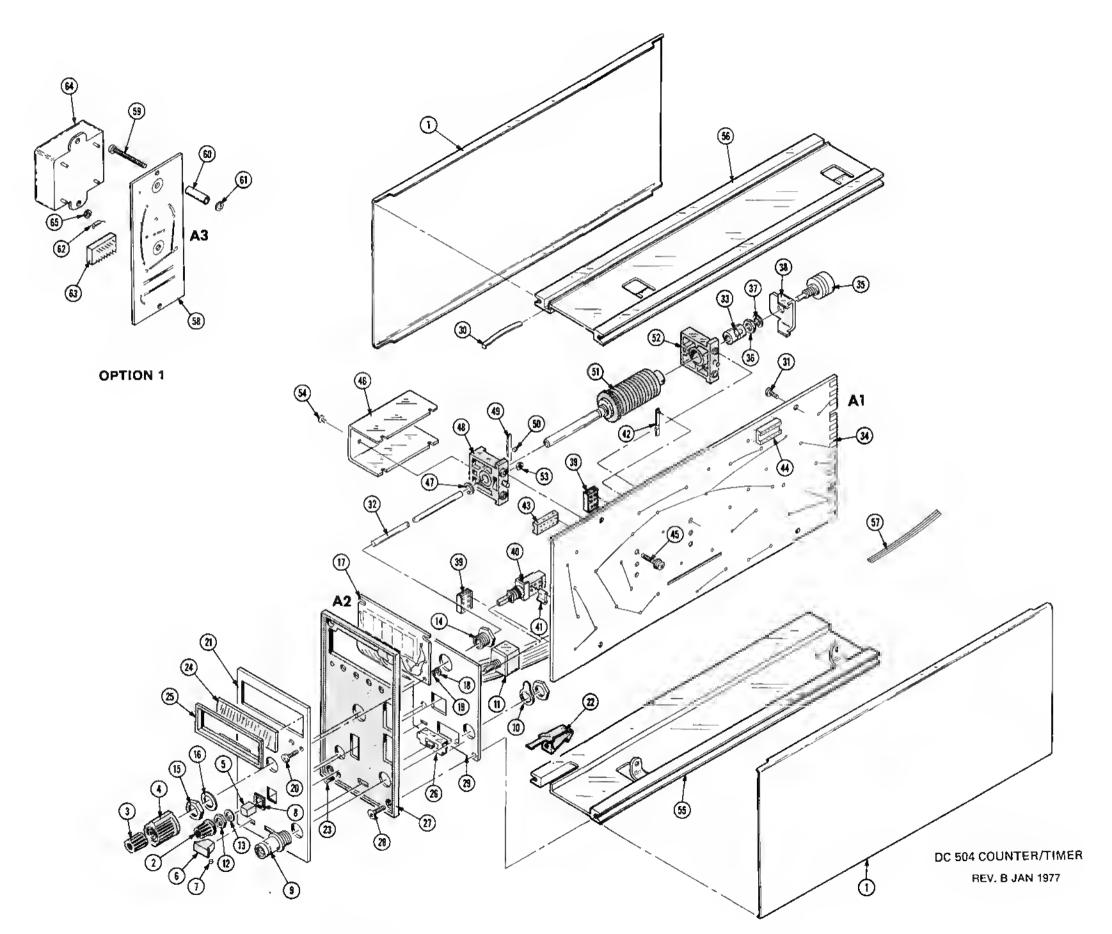
Index	Tektronix	Serial/Mo	del No.				Mfr	
No.	Part No.	EH	Dscont	Oty	1 2 3 4 5	Name & Description	Code	Mfr Part Number
		_						
1-1	337-1399-00			2	SHLD, ELECTRIC	CAL:SIDE	80009	337-13 <del>9</del> 9-00
2	366-0494-00			1	KNOB: GRAY WI	TH SETSCREW	80009	366-0494-00
	213-0153-00			1	.SETSCREW:5-4	0 X 0.125,STL BK OXD.HEX	000CY	ORD BY DESCR
3	366-1031-05			1	KNOB:RED-CA		80009	366-1031-05
	213-0153-00			1		0 X 0.125,STL BK OXD,HEX	000CY	ORD BY DESCR
4	366-1170-01			1	KNOB:GRAY.4 S	-	80009	366-1170-01
-	213-0153-00			2		0 X 0.125.STL BK OXD.HEX	000CY	ORD BY DESCR
	366-1257-30			1	PUSH BUTTON:		80009	366-1257-30
5		B010100	B033829	1	KNOB:LATCH	GRAT-NESE!	80009	366-1422-00
.6	366-1422-00		B033629	1		53 X 0.23 X 1.059	80009	366-1690-00
	366-1690-00	B033830		•		ACHING PARTS)********	80003	300-1030-00
. 7	214-1840-00	B010100	B033829	1	PIN.KNOB SEC	RG:0.094 OD X 0.120 INCH LONG	80009	214-1840-00
•	214.10.10.00	00.0.00	2000000		(END	ATTACHING PARTS)******		
8	426-0681-00			1	FR.PUSH BUTT		80009	426-0681-00
9	131-0955-00			1		EC:BNC,FEMALE	13511	31.279
	131-0335-00					ACHING PARTS)********		
10	210-0255-00			1		:0391 ID.LOCKING.BRS CD PL	80009	210-0255-00
	E (0-0E3D-00					ATTACHING PARTS)******		
-11				1	RES., VAR: (SEE			
	*****			•		ACHING PARTS)************************************		
	010 0582 00			1		:0.25-32 X 0.312 INCH.BRS	73743	2X20317-402
12	210-0583-00						79807	ORD BY DESCR
. 13	210-0940-00			1		0.25 ID X 0.375 INCH OD.STL	19001	OND BY DESCR
						ATTACHING PARTS)	00000	358-0029-00
. 14	358-0029-00			1		ID:HEX,0.375-32 X 0.438' LONG	80009	350-0025-00
						ACHING PARTS)************************************		mundana 400
-15	210-0590-00			1		.:0.375-32 X 0.438' BRS	73743	2X28269-402
16	210-0978-00			1		0.375 ID X 0.50 INCH OD,STL	78471	ORD BY DESCR
						ATTACHING PARTS)*******		
-17				1		SY:DISPLAY(SEE A2 REPL)		
					(ATT	ACHING PARTS)********		
18	210-0405-00			2	NUT, PLAIN, HEX	:2.56 X 0.188.BRS.CD PL	73743	12157- <del>5</del> 0
-19	210-0001-00			2	WASHER, LOCK	#2 INTL,0.013 X 0.18 OD,STL	78189	1202-00-00-0541C
.20	211-0159-00	B010100	B032859	2	SCREW, MACHII	NE:2-56 X 0:375 INCH,PNH STL	87308	ORD BY DESCR
	211-0034-00	B032860		2	SCREW, MACHII	NE:2-56 X 0.50 INCH,PNH	83385	ORD BY DESCR
	361-0019-00	8032860		2	INSULATOR, DIS	K:0.094 DIA X 0.078 INCH L	80009	361-0019-00
					*******(END	ATTACHING PARTS)******		
					CKT BOARD AS	SY INCLUDES:		
	136-0252-04			4	SOCKET, PIN TI	RM:U/W 0.016-0.018 OIA PINS	22526	75060-007
	175-5366-00	B040460		1	.CA ASSY.SP.E.	LEC:6,26 AWG,7.0 L,RIBBON	80009	175-5366-00
	131-0707-00	B040460		6		C:22-26 AWG,BRS & CU BE GOLD	22526	47439
	352-0164-01	B040460		1		ONN:6 WIRE,BROWN	80009	352-0164-01
	175-5367-00	B040480		1		EC:10,26 AWG,B.0 L,RIBBON	80009	175-5367-00
	131-0707-00	B040460		10		C:22-26 AWG,BRS & CU BE GOLD	22526	47439
	352-0168-01	B040480		1		ONN:10 WIRE, BROWN	80009	352-0168-01
24	333-1783-00	5010100		i	PANEL, FRONT:	014.10 111.12,51101111	80009	333-1783-00
.21		0010100	B033829	i	LCH.PLUG-IN R	ET:	80009	214-1513-01
.22	214-1513-01	B010100	0000029	1	LATCH, RETAINS		80009	105-0719-00
	105-0719-00	B033830		1		ACHING PARTS)********	00003	100-0110-00
							45722	ORD BY DESCR
-23	213-0254-00			1		:2-32 X 0.250,100 DEG,FLH	43122	OND BY DESCR
				_		ATTACHING PARTS)	00000	105 6710 60
	105-0718-00	B033830	B035989	1	BAR, LATCH RL		80009	105-0718-00
	105-0718-01	B035990		1	BAR,LATCH RL		60009	105-0718-01
-24	331-0314-00			1	WINDOW, READ		80009	331-0314-00
- 25	426-0916-00			1	FRAME, ROOUT		80009	426-0916-00
.26				1		(SEE S100 REPL)		
.27	386-2292-00			1	SUBPANEL, FRO		80009	388-2292-00
					FTA)************************************	ACHING PARTS)********		
-28	213-0229-00	B010100	B036279	4	SCR,TPG,THO F	OR:6-20 X0.375*100 OEG,FLH ST	93907	ORD BY DESCR
	213-0123-00	B036280		4	SCREW, TPG, TF	:6-32 X 0.375,SPCL TYPE.FLH	93907	ORD BY DESCR
					(END	ATTACHING PARTS)*******		
-29	337-1888-00			1	SHIELD, ELEC:		60009	337-1888-00
-30	214-1061-00			1	SPRING,GROUN	ID:FLAT	80009	214-1061-00
				1		SY:FUNCTION SWITCH(SEE A1 REPL		
						ACHING PARTS)		
-31	213-0146-00			4		OR:6-20 X 0.313 INCH,PNH STL	83385	ORD BY DESCR
	210-0005-00			4		#6 EXT,0.02 THK,STL	78169	1106-00
	F 10-6600-00			•		ATTACHING PARTS)******		

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Index	Tektronix	Serial/Mo		Δ.		Mir	NII Barrer
No.	Parl No.	Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Code	Mir Part Numbe
1.	17711 00000				CKT BOARD ASSY INCLUDES:		
32	384-1290-00			1	EXTENSION SHAFT: 0.125 OD X 4 660 INCH LON	80009	384-1290-00
33	376-0051-01			1	.CPLG,SHAFT,FLEX.0.127 ID X 0 375 OD	80009	376-0051-01
34				1	.CKT BOARD ASSY:MAIN(SEE A1 REPL)		
35				1	RESVAR:(SEE A1R190 REPL)		
					(ATTACHING PARTS)********		
36	210-0583-00			1	NUT.PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
37	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL.0.018 THK,BRS	78189	1214-05-00-05410
38	407-0803-00			1	BRACKET,ELEC SW:BRASS	80009	407-0803-00
					(END ATTACHING PARTS)*******		
	131-0566-00			2	BUS CONDUCTOR: DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
	214-0579-00			1	TERM.TEST POINT:BRS CD PL	80009	214-0579-00
				•	. (STANDARD ONLY)		
39	1 ***** ******			4	SWITCH.SLIDE.(SEE S102,160.210.245 REPL)		
40				1	SWITCH,PUSH:(SEE S235 REPL)	00000	224 2222 22
41	361-0383-00			2	SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
42	131-0604-00			12	CONTACT.ELEC.CKT BD SW.SPR.CU BE	80009	131-0604-00
	400 0000 00	0010100	6044646		(SEE MAINTENANCE SECTION FOR REPAIR)	09922	DILB16P-108T
43	136-0260-02	B010100	B041289	8	SKT.PL-IN ELEK:MICROCIRCUIT,16 DIP.LOW C SKT.PL-IN ELEK:MICROCKT.14 CONTACT	09922	DILB14P-108
44	136-0728-00 136-0269-02	B041290 B010100	B041289	1 20	SKT.PL-IN ELEK:MICROCIRCUIT,14 CONTACT	09922	DILB149P-108
44	136-0729-00	B041290	0041203	1	SKT.PL-IN ELEK:MICROCKT.16 CONTACT	09922	DILB16P-108T
	131-9608-00	B010157		16	TERMINAL PIN 0 365 L X 0.025 PH BRZ GOLD	22526	48283-036
	136-0234-00	B036570		2	SOCKET,PIN TERMIO.088 OD X 0.247 INCH L	00779	380598-1
	136-0252-04	B036570		6	SOCKET, PIN TERM: U/W 0.016-0 018 OIA PINS	22526	75060-007
	175-5364-00	B040460		1	CABLE ASSY, RF:50 OHM COAX, 12.0 L.9-4	80009	175-5364-00
	175-5365-00	B040460		1	CABLE ASSY,RF:3.26 AWG.4.0 L.RIBBON	80009	175-5365-00
	263-1031-00	2012100		1	SW CAM ACTR AS:FUNCTION	80009	263-1031-00
	200 1001 00				(ATTACHING PARTS)		
45	211-0116-00	B010100	B039689	4	SCR, ASSEM WSHR: 4-40 X 0.312 INCH.PNH BRS	83385	ORD BY DESCR
	211-0292-00	B039690		4	.SCR.ASSEM WSHR:4-40 X 0.29.BRS NI PL (END ATTACHING PARTS)************************************	78189	ORD BY DESCR
46	200-1010-00			1	COVER, CAM SW:12 ELEMENT, 0.83 INCH DIA	80009	200-1010-01
47	354-0219-00			i	RING.RETAINING:FOR 0.25 INCH SHAFT	79136	5103-25-MD-R
48	401-0057-00			1	BEARING,CAM SW:FRONT	60009	401-0057-00
49	214-1139-03			1	SPRING,FLAT:RED COLORED	80009	214-1139-03
	214-1139-00			1	SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR	80009	214-1139-00
50	214-1127-00			1	ROLLER, DETENT: 0.125 DIA X 0.125, SST	80009	214-1127-00
51	105-0558-00			1	ACTUATOR,SWITCH:	80009	105-0558-00
52	401-0056-00			1	BEARING,CAM SW:REAR	80009	401-0056-00
53	210-0406-00			4	NUT,PLAIN,HEX:4-40 X 0.188.BRS.CD PL	73743	12161-50
54	211-0022-00			2	SCREW,MACHINE: 2-56 X 0.188,PNH,STL,CD PL	83385	ORD BY DESCR
	210-0001-00			2	WASHER,LOCK: #2 INTL.0.013 X 0.18 OD,STL	78189	1202-00-00-05410
	210-0405-00			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS,CD PL	73743	12157-50
	386-3657-00	B033860	B036559	2	SUPPORT,PLUG-IN:	80009	386-3657-00
	386-3657-01	B036560		2	SUPPORT, PLUG IN:	93907	ORD BY DESCR
	210-1270-00	B033860		2	WASHER, FLAT: 0.141 ID X 0.04 THK, AL	80009	210-1270-00
55	426-0724-04			1	FR SECT, PLUG-IN: BOTTOM	80009	426-0724-04
56	426-0725-05	0040400	0010100	1	FR SECT, PLUG-IN: TOP	80009	426-0725-05 198-2213-00
E 7	198-2213-00	B010100	B040459	1	WIRE SET,ELEC: .WIRE,ELECTRICAL:3 WIRE RIBBON	80009 80009	175-0826-00
57	175.0826-00	B010100	B040459	FT FT	.WIRE,ELECTRICAL: 5 WIRE HIBBON	08261	SS-0626-7106100
	175-0829-00 175-0833-00	B010157 B010157	B040459 B040459	FT	.WIRE.ELECTRICAL: 10 WIRE RIBBON	08261	SS-1026-7
	131-0707-00	B010157	B040459	16	.CONTACT,ELEC:22:26 AWG,BRS & CU BE GOLD	22526	47439
	352-0164-01	B010157	B040459	1	HLDR, TERM CONN:6 WIRE, BROWN	80009	352-0164-01
	352-0168-01	B010157	B040459	1	.HLDR, TERM CONN:10 WIRE.BROWN	80009	352-0168-01
	175-1020-00	B032860	B040459	FT	CABLE RF:50 OHM COAX, WHT POLYTHN JKT	90464	DAB70JAAAWHIT
58	173-1020-00		UT 10100	1	CKT BOARD ASSY:TIME BASE(SEE A3 REPL)		
					(OPTION 01 ONLY)		
					(ATTACHING PARTS)		
59	213-0206-00			2	SCR, TPG, THD FOR:6-32 X 1.25 INCH, PNH STL	86113	ORD BY DESCR
60	361-0682-00			2	SPACER, SLEEVE: 0.648 X 0.189 BRS	80009	361-0682-00
61	210-0006-00			2	WASHER,LOCK:#6 INTL,0.018 THK,STL CD PL	78189	1206-00-00-05410

Fig. & Index	Tektronix	Serial/Mo	idel No.				Mfr	
No	Part No.	Eff	Dscent	Oty	1 2 3 4 5	Name & Description	Code	Mfr Part Number
۲.	*****				CKT BOARD ASSY INCLUDES:			
-62	131-0566-00			1	BUS CONDUCT	OR.DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
-63	136-0269-02	B010100	B041419	1	SKT, PL-IN ELEK	:MICROCIRCUIT,14 DIP	09922	DILB149P-108
-64	***** *****			1	.OSCILLATOR(SI	EE A3Y10 REPL)		
-65	210-1014-00			4	.WASHER,NONN	ETAL:0.094 ID X 0.312" OD,TEFL	80009	210-1014-00

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### ACCESSORIES

Fig. &

REV. C JAN 1977 DC 504 COUNTER/TIMER